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[OFFICIAL NOTICE.]

December Meeting, Guild of Gas Managers.

OFFICE OF THE SECRETARY, December 2, 1895.

The December meeting of the Guild of Gas Managers will be held at Young's Hotel, Boston, Mass., at noon, of Saturday, the 14th inst.

A. K. QUINN, Secretary.

BRIEFLY TOLD.

CAUSE FOR THANKSGIVING.—That the gas men have cause for thankfulness this year needs no iteration at our hands, for they have told it amongst themselves many a time during the past season, and particularly so in the last two months. Indeed, the standing of the industry to-day, compared with its position of a year ago, gives as much cause for amazement as it does for thankfulness. Almost without exception, the reports received by us regarding sendout are to-day vastly over what they were a year back, and the feeling is that we are more than well past the threshold pointing the way to a long-continued and sustained era of advance and prosperity. It is also our satisfactory province to add that the existing flourishing condition of the industry seems to be due to more harmonious relations between the working engineers and the investing capitalists than those which have been recorded for many a day. Perhaps it is that the gas capitalist has been forced to the conclusion that his capital is safest when its augmentation is largely trusted to the skill of the engineering force that evolves and carries out the advances in engineering practice which enable the employer to reap a greater benefit to-day out of the same thing than he reaped from it yesterday or the day before. Whether so or not, the satisfaction of both is increased in the knowledge that each is coming to place greater reliance on and faith in the other than formerly obtained.

THE CHANGE IN MANAGEMENT, SYRACUSE, N. Y.—It is officially settled that the Gas Light Company, of Syracuse, N. Y., has passed into new management, and that the change in proprietorship was a matter of fair bargain and sale, rather than an amalgamation or union brought about after a season of strife and warfare. In this we do not wish to be considered as yielding one whit of our belief that the Hiscock-Dunfee opposition gas charter, granted by the local officials of Syracuse some months ago, and which made the sale and purchase of the old Company a possibility, through harrassment—and, if not the latter—through the indisposition of its owners to go on unpleasantly in a business they had fairly carried on for many years, was a disgrace to those who passed it. However, aside from speculation or comment, we may here say that the investing parties in the successor Company (every share of the old stock having come in) are Messrs. R. C. Pruyn, W. L. Elkins, Jr., J. and W. Seligman, Hollister and Babcock, E. McMillin & Co., and Humphreys & Glasgow. The executive management chosen by the purchasers is: Directors, W. L. Elkins, Jr., Stephen Peabody, A. C. Humphreys, Henry Seligman, R. C. Pruyn, H. N. Babcock, W. S. Andrews, Horace White, A. N. Palmer, J. H. Moffit and M. A. Knapp; President, R. C. Pruyn; Vice-President, A. C. Humphreys; Treasurer, Stephen Peabody; Secretary, H. N. Babcock. From this it will be seen that Mr. Babcock, of the old guard, yet remains at his post; and also that Mr. A. C. Wood has retired from the field in which he labored so arduously, honestly and successfully. But the staunch Syracusan's crowning glory comes from the knowledge that the examining engineers, on behalf of the purchasers, were a unit in expressing their unqualified commendation of the plant which they proposed to buy, and that had been evolved by him at piecemeal, though in happy sequence, during times when the supplying of gas to the Salt City was a very much more complicated problem than it will ever be again. Mr. Austin C. Wood's career in the history of the gas supply of New York State stands for everything that represents honesty and success.

THE "JOURNAL OF GAS LIGHTING" ON EX-PRESIDENT CLARK'S ADDRESS.—The following editorial mention, from the London *Journal* of November 5th, is submitted for the thought of our readers:

The 23d annual meeting of the American Gas Light Association was held in Philadelphia from October 16 to 18, under the Presidency of Mr. Walton Clark, of that city, whose address was devoted chiefly to a critical examination of Gas Managers' Associations in general, and the

American Association in particular. Mr. Clark is reputed a man with ideas, and his address bears out the author's reputation. A good deal of what he says about the American Association applies with equal force to other organizations of the kind in which our British readers are more particularly interested. He observes, to begin with, that these voluntary Associations of men are as good as the associated deserve, for they are what the associated make them—a profound saying, and one worthy of acceptance by all whom the subject may concern. If an Association lacks the standing and efficiency expected by its founders and desired by its true friends, it is only because the members prefer to have it as it is, or are incapable of improving it. Mr. Clark does not believe that the American Association is all that it ought to be; and accordingly he takes it upon himself to speak a few home truths respecting the reason why the efficiency of the organization is low. He does not find fault with the papers read before the Association—rightly admitting that among the transactions are to be found many technical memoirs of the highest quality. He does complain, however, in regard to the quality of the discussions. Too few members join in discussing papers, and what they say usually amounts to very little. His is not the only technical society troubled with the same constitutional weakness. The trouble is partly due to the lack of opportunity for preparation, partly to lack of interest, and partly, no doubt, to hurry. Most societies nowadays follow the plan of distributing prints of papers beforehand, so that members may get up a case for or against the author's views as they may prefer. But what is to be done when, as too often happens, papers trumpeted in advance as of the first importance do not reach the printers' hands before the very eve of the meeting? The circumstance of its being usually the "prominent members" of the society who offend in this way renders all suggested remedies hopeless. With regard to the hurrying of discussions, Mr. Clark declares it a mistake to hold, as most presidents and councils do, that "the greatest good comes from the reading of all the papers presented, whether or not time is left for discussion." He believes that "the discussion of a paper should not be cut to leave time for the reading of another; that one paper thoroughly discussed is of more value to us than many papers without discussion." He is largely right in this regard. Mr. Clark strongly recommends the establishment by the American Association of technological examinations in gas manufacture on the lines of those conducted by the City and Guilds of London Institute, which he esteems as admirable, but "insufficient to meet the occasion." Surely, it must have been a help to many a student in gas manufacture, as practiced across the Atlantic, to learn from the English question papers what it is that passes for knowledge of the rudiments of the industry. It would be gratifying to know how much farther this kind of educational effort can be extended. Mr. Clark made a considerable number of recommendations to the American Association with the object of improving it and increasing its usefulness, the fate of which is scarcely doubtful. It is not so much what a technical society professes to do for its members, by remitting all sorts of business to committees with high-sounding names, that renders it respectable, but it is the character or quality of the membership itself that attracts or repels the best element of the personality of the calling which the society pretends to represent. When good men of any order or class of the community are invited to join a club or a society, it is more important to them to know what the company is like than what the organization is called or what is inscribed upon the official programme. The American Gas Light Association, like many others, has suffered, and is still suffering, from commercialism, internecine rivalries, troubles with the national technical press, and one or two other afflictions that need not be mentioned here. But it still numbers among its members some of the brightest and best men in the whole worldwide profession of gas engineering; and while these continue to attend and take part in its meetings, the transactions will not lose interest for the technical world.

NOTES.—Mr. Paul A. Doty, formerly of Paterson, N. J., has been appointed Engineer of the Consolidated Gas Company, which proposes to supply gas to the residents on and along the north and middle southern coast line of New Jersey. The Company is to be congratulated over having secured the services of such a competent engineer.——Mr. Clarence Deshong has been appointed to the vacancy in the Board of Dirpctors of the Chester (Pa.) Gas Company, occasioned by the death of Mr. John O. Deshong.——The Acme Gas Fuel and Construction Company, to operate in Brooklyn, N. Y., has been incorporated in New Jersey. Its nominal capital is $100,000. The scheme on its face looks to be quite inoffensive; but our belief is there is more of a mask about it at present than there is of real feature. In fact, it is likely to show later on that it has a nose of its own.

Summary of the Discussion on Mr. A. C. Humphreys' Paper,[1] on "The Commercial Value of Photometry," Read before the American Gas Light Association, October 17th, 1895.

Mr. Humphreys, before commencing to read his paper, apologized for not having sent it in in time to enable the Secretary to place the printed copies in the hands of the members for previous study. A prolonged illness was the reason for the delay.

Mr. Chollar opened the discussion by referring in a complimentary strain to the paper, but took the ground that, in spite of Mr. Humphreys' arguments, nine-tenths of those familiar with photometrical work were of opinion that there was somethg wrong. If n aked lights are covered by opal globes, the photometer says 60 per cent. of the light is lost; but the effect is to make the light softer and more diffusive. He had looked in dictionaries and scientific works for a specific definition of a diffusive light, and of the property of diffusiveness of light, without success—something here which the photometer does not explain. He admitted that light from a point decreases inversely as the square of the distance; but light approaching a point, as in case of convex lens, increases in proportion to the square of the distance, otherwise the telescope and microscope would be impossibilities. Without such increase there could be no focus. Parallel rays, such as the rays of the sun, neither increase nor decrease. Light from a globe gives converging, diverging and parallel rays; light from a point gives only diverging rays and consequently is not diffusive; light from a globe is soft and diffusive. The definition of diffused light is that it does not decrease in proportion to the square of the distance. Light converging to a point advances in concave waves, the reverse of light from a point. If one decreases according to the square of the distance, the other must decrease. Parallel rays, as from the sun, reach out indefinitely. The trouble with the photometer is that it takes no account of softness of light. A soft light is more like a glow. In the commercial testing of gas lights, the light should be entitled to a correction in proportion to the angle it subtends—in proportion to the size of flame and inversely with the sharpness of shadow. Light from the arc light approximates closely to the law of inverse squares and casts a sharp and intense shadow; but light from the clouds, composed of diverging rays, is a soft and diffused light.

Mr. Hinman thought that Mr. Humphreys' paper left little to be said. He thought that Mr. Humphreys had demonstrated the complete accuracy of the bar photometer for measuring amount of light from different sources. But there are some other things it does not measure, as color and intensity per unit of source. He thought the much discussed diffusibility was simply a question of intensity. For example, in examining a printed page the effect depends upon the surroundings. If the eye meets a bright light, the page may be insufficiently illuminated; whereas the same amount of illumination on the page in an otherwise darkened room would give a brilliant effect. It is a question of the eye and the surroundings. A light giving less light may be more valuable because of more uniform distribution. A light of high intensity within the range of vision confuses the eye and good effects are not obtained. As to shadows, with a large light of low intensity, to obtain the same candle power the flame must be larger, and so the shadows are not so sharp. This question of shadow is practically of great importance. Referring to the details of photometry various points are to be considered. First, the question of the standard and the test burner. If the law designates a certain test burner that question is settled, but the legal burner is not necessarily the one employed in practice, and the results obtained are often widely different. He had tested gas in the Argand (which happened to be the one best adapted) and found 16 candle power, and with flat-flamed burners obtained, with the same gas, only 8 or 10 candle power. With regard to standards, candles or pentane, he thought there was something to be said on both sides. Candles, properly used, are fairly reliable. He had not used the pentane standard, but there seemed no doubt it was more uniform, though possibly harder to use. With regard to style of photometer, he preferred the cabinet to the open form, but it is important the former should be properly and amply ventilated. With regard to the disc, he had used both the Bunsen and the Leeson star disc and preferred the former, but thought good results could be obtained with both. He thought it necessary to use two mirrors, and regarded the reversal of the disc as of great importance. He had found the readings of the two sides of a disc to vary as much as four candles; frequently the variation would be one candle. As to corrections for barometer and thermometer, they were necessary for scientific work. But in the United States there were some cities at a great distance above the level of the sea, and the

1. See JOURNAL, Nov. 4, 1895, p. 727.

consumer was not likely to be satisfied by the statement that at a barometer of 30 inches the candle power *would* be 25. He did not suppose that any companies corrected their bills by the barometer.

Mr. Prichard said he had become interested in this subject some years ago, and believed that the illuminating value of gas, as measured on the bar photometer, differed from its commercial value. At the time referred to the arc light had recently entered the field and the ratings of candle power given out in connection with these lights were an incentive to look into the matter. As he looked into the matter he became more and more convinced of the difference spoken of. That there was such a difference he thought was true, for several reasons; and he thought that Mr. Humphreys' complete paper bore out this idea. Mr. Humphreys says: "That a measurement of the spherical candle power of the light-source and the determination of its color composition will, as far as possible, enable us to estimate the light effect obtainable under varying conditions." Apparently two of the reasons for this difference were here shown. In comparing an incandescent lamp and a gas flame, the horizontal bodies of rays coming from each lamp are measured and both are said to be 16-candle power. With the arc light, its light is measured at 45° from the horizontal, and then it is claimed to be of 2,000 candle power. Such a claim is not fair to the incandescent light and the gas light. If measured spherically the candle power of the arc would be only 500. While he did not know as to the spherical candle power of a gas flame he thought it varied with the maximum candle power and with different kinds of flames and with the thicker flame of water gas. This one point alone showed the difference between the photometric and the commercial values. He also thought, as suggested by Mr. Hinman, there was a difference as to the area of the light-source. It must make a great difference whether the source was 3 square inches, as in a gas flame, or .0035 inch, as in an incandescent lamp, or .1 inch, as in the arc lamp. To give us an estimate of the commercial value of a light, the photometer should take notice of this difference of area. Reference had been made in the paper to the illuminating of a building at the Louisville Exposition. It looked to be brilliantly illumined, though the grade of illumination was low, for there was no one bright spot to meet the eye. If, upon entering a room, an arc lamp is found to be level with the eyes, it is not possible to distinguish anything. And so, in a smaller degree, with an incandescent lamp, and in a still smaller degree with a gas light, and least of all with a gas jet inclosed in an opal globe. This is the reason why the light surrounded by an opal globe is considered as giving a better effect in spite of the photometric value being reduced. As to color there should be discrimination. An equal amount of red light or green light thrown into the meeting room would fail to illuminate it as well as the lights then and there in use.

Dr. Love said that the paper naturally interested him greatly, for he had been for 20 years engaged daily in photometric work. He thought that the theoretical points of the subject could be best discussed by physicists. He coincided substantially with the paper, and thought they were under obligations to the author, who had threshed out the subject so well. He was glad Mr. Humphreys had considered the subject from the spherical wave standpoint. It was misleading to consider light as moving in straight lines. He would, with their permission, call attention to his own methods in photometry. For nearly 20 years he had used the star disc inclosed in glass. He first tried the Bunsen, and then the Leeson disc, but found the latter unsatisfactory on account of the "buckling" of the paper. Dibdin had not at that time suggested his improvement. He devised the glass inclosed disc 18 years ago, and had found it satisfactory; and he thought that anyone who used it would never go back to the grease spot disc. Every disc should be tested by reversing. With the glass side disc, if once found true, it was apt to remain so longer than other discs. The glass tended to prevent change. The reversing of the entire box was more important than reversing the disc alone, and this was a most important suggestion of the Dutch Committee. With regard to candles, Dr. Love expressed the opinion that the United States was the dumping ground for all the poor candles made. He thought he had wrestled with this subject more than had the Gas Commissioners of London. He allowed himself a margin of 6 grains either way from 120 grains. There are some small points which account largely for the variation in candle results—such as particles of inorganic matter on the end of wick, soot on the wick, the curling of the wick. Candles burning under these conditions gave unreliable results. With regard to Dibdin's standard, he thought it was going to be a good thing for those regularly engaged in laboratory work, but feared it would be troublesome for the gas engineer. No doubt it would be more reliable for scientific work. But he feared it would be too expensive. As to the objection that the unit was still the candle, he would suggest that all standards are arbitrary.

Mr. Somerville said that the reading of this paper showed the importance of having the papers printed and distributed in advance of the meeting, that the members might properly prepare for the discussion. The discussion of such a paper was all important, and it could not be properly discussed unless read and studied in advance. He was reluctant to give up the use of the word "diffusive," as objected to by Mr. Humphreys. It seemed to him that there was a difference in the diffusive qualities of lights. He could tell a gas-lighted store 100 yards away—the light flooded from the windows. This was not so with the incandescent electric light. Again, the electric light, as used for lighthouses, was not nearly so efficient as the old oil or gas lamp of much lower nominal power. Was not this due to a difference in "diffusive" power?

Mr. Miller felt that nothing he could say could add to the strength of the paper. The ground was covered and nothing left to be said. He would call attention to a typographical error at bottom of page 199, where Mr. Chollar was quoted in reference to the law of inverse squares, where the statement was made that the surfaces of spheres are *inversely* as the squares of their diameters. This evidently was intended to read *directly* as the squares of the diameter. (Mr. Humphreys replied "Yes.") He would ask Mr. Humphreys what had been with him the result of increase of temperature and poor ventilation in the photometer room. Did it tend to make the candle power read higher or lower? Some of his experiences tended to show the effect was to make the reading against the gas, which to him did not seem to be theoretically correct. With regard to the point raised by Mr. Somerville in connection with lighthouse work, he thought the point made was outside the premises. The paper assumed that the atmosphere was transparent. The reason a red light would do better in a fog was because it contained more of the red rays, and they were less refrangible. This was shown in the case of the setting sun.

The President asked Dr. Love and Mr. Hinman to give their experience in connection with the point raised by Mr. Miller, in regard to the effect of a vitiated atmosphere upon the apparent candle power of the gas.

Dr. Love thought that theoretically it should affect both lights alike; but he had not made any exact observation in connection therewith.

Mr. Hinman recalled a case which supported Mr. Miller's experience, the candle power reading being reduced by the improper ventilation. Whether or not this was a general experience he was not prepared to say.

Mr. Forstall recalled that, in a paper read before one of the British Associations, by Mr. Methven, it was shown that an increase of the moisture in the air tended to depreciate the apparent value of the gas.

Mr. Egner thought that there was some optical illusion in connection with these questions of intensity and diffusion. If we look at a 16-candle power electric light and a 16-candle power gas light, the former dazzled the eye the more because it was more intense. That probably led people to think the gas light was more diffusive. The quantity of light was the same in each case, but in one case the intensity was much greater than in the other case.

Mr. Humphreys, in replying, first expressed regret that apparently the paper and his object in writing it was by some misunderstood, but the responsibility he appreciated rested upon him as he had not finished it in time for the members to study in advance. As explained, this was more his misfortune than his fault. He had, however, sent typewritten copies in advance to the members selected by the President to lead in the discussion. He apologized to Mr. Chollar for not having also sent him a copy. The paper was written with the idea of showing how the eye was deceived, and how the discrimination should be made between facts and optical illusions. These modifying circumstances could not be provided against unless they were first located and defined. The eye is deceived but the photometer is not. The photometer measures light by its effect, but does not measure the light-source. He did not believe that there was any such general disbelief in the accuracy of the photometer as Mr. Chollar claimed. As claimed by Mr. Chollar, there was a difference in the light-effect, whether or not a globe was used to inclose a light-source, and he had endeavored to show the cause of that difference. One reason was that the globe gave a more uniform spherical distribution. Even a transparent chimney tended to so reduce the spherical variation, and a translucent globe had a marked effect in this direction. The shielding of the eye from the direct rays from the light-source was another reason for the difference. As to diffusion, he understood that the diffusion of light was its irregular reflection from surfaces other than those of reflectors. To compare the value of light-sources,

the light must be compared before there has been any diffusion, and this was as fair for one light as for the other. As to Mr. Chollar's reference to the use of lenses and reflectors in the case of telescopes, microscopes, etc., he thought there was hardly any necessity for reply. Light from a point naturally would be distributed spherically. But if a larger effect were required for a special purpose, and the light was required to be sent all in one direction, a lens was used to concentrate or squeeze the light together and send it forth in the one direction only. But there is nothing in such action to disprove the law of distances. The law cannot be employed to measure the light given through a lens, because by the use of the lens the very spherical distribution upon which the law depends is rendered impossible. The rate of variation of intensity where a lens is used depends upon the character of the lens. In the case of the globe the opposite effect is found, as the tendency is to make the spherical distribution more uniform. It is true that these and other effects are not obtained in the photometer. The measurement is made by comparing the lighting effects of the direct rays upon a white disc, and before any distributing elements have been brought into the comparison. The experiments made in connection with his former paper showed that the same results were obtained from different classes of light sources. The light sources were balanced against each other at equal distances from the disc. Then they were each moved out one foot from the disc and the balance was found to be maintained. Again and again the lights were moved away by equal distances, and still no difference was found on the disc. Such men as Glasgow, Collins and Rusby assisted in these experiments, and failed to find any difference in the carrying power of the light. In the recent experiment of the same kind, comparing the light from gas flame and kerosene oil flame, Dr. Elliott, of New York, had ageed with him in failing to find a difference. Mr. Humphreys' then asked the question, "If there is this difference of 'diffusive' power, why did it not show itself on the photometer disc in these experiments." The diffused light cannot be fairly compared. A colored wall will reflect more or less of the original light falling upon it according to whether the light contains more or less of the rays of that color. Such conditions cannot be provided for in advance, because all sorts of such conditions will be met. The different rooms of the same house, illuminated by the same light-source, will give varying lighting efficiencies, on account of the variations in the color absorption. As to shadow effects, he had simply touched on the subject as the paper was already too long. Necessarily, as the light-source increases in size, light therefrom will get behind the shadow-making object more or less, and the effect will be softened and the general illuminating effect more uniform. That in no way disproves or has any connection with the law of distances. The best effects can only be obtained by recognizing the governing laws, then determining the modifying causes and keeping the latter in mind. Mr. Hinman spoke of a gas tested by the Argand giving 16 candle power and later with flat flame burners giving only 8 or 10-candle power; but Mr. Hinman would not claim this affected the accuracy of the photometer, rather simply that the light-source was reduced in value by the use of an improper burner. This is not a question of light distribution, but a question of efficiency of application of the gas. He was decidedly of the opinion that the improved star disc gave the most reliable results, and especially where there was difference of color in the lights. The points of the star should be observed. As to correction for the barometer in very high altitudes, he thought two different corrections should be made. For local comparison of results, the correction should be made to the average local barometer as recorded at the War Office in Washington; but for general comparison of results, as for instance in such an Association as the one then in session, the correction should be made to the standard barometer. In a company he was formerly connected with, controlling many works in as many different places, this was an important question, and it was settled in the way mentioned. Mr. Prichard had referred to his admission that the measurement of the spherical candle power and the determination of the color composition of a light-source would, as far as possible, enable one to estimate the light effect obtainable under varying conditions. This he thought was in accord with the rest of his paper. He was prepared to admit the facts as he found them. If an arc lamp is measured at 45° and the candle power so determined is taken as the candle power of the lamp, the one accepting such a statement is in the wrong, not the photometer. It stood to reason that for general illumination the average spherical intensity must be considered. With regard to the case quoted in connection with the Louisville Exposition, it simply went to show how the working of the eye had to be considered in problems of illumination. There was nothing here to impeach the accuracy of the law of distances, but there was something to show other laws had also to be considered. He could not speak of his own knowledge as to the pentane standard, for the instrument before them had only the day before been released from the custom authorities; but the names attached to the report of the Standards Committee were sufficient guarantee for the claims made in its behalf. He thought Dr. Love rather overrated the complexity of the instrument, and he saw no reason why, after a time, it should not be made in this country, and so keep the cost down to a reasonable figure. As to Mr. Miller's question upon effect of lack of ventilation, in a recent case in his experience, using an open bar in an insufficiently ventilated room, he found the effect was to reduce the candle power of the gas. Dibdin gives the accounts of results for and against the gas. Referring to Mr. Somerville's disinclination to give up the use of the word "diffusive" as applying to the quality of a light, he had also found it hard to settle upon another word, and had been obliged to fall back upon "penetrating-power," "carrying-power," etc. He thought we should be careful to bear in mind that diffused light is irregularly reflected light, and that this should not be confounded with the improper (as he thought) reference to diffusive quality of light. He did not think it had been demonstrated, or that it could be demonstrated, that there was any such difference in the quality of different lights; but, on the other hand, he had been able, as shown, to make experiments to demonstrate that the differences so claimed in certain cases did not exist. As to the relative efficiencies of lighthouse lamps, it was a question of the transparency of the medium. It was claimed that the light from the electric arc would not penetrate fog as well as the light from an oil or a gas flame, and while the claim was disputed he believed it to be correct. But this is a question as to the effect of a certain absorbent upon a light of certain color composition. It is a very practical and important question, but does not furnish an argument as to relative diffusibility of different kinds of light.

[Prepared for the JOURNAL, by DR. W. H. BIRCHMORE.]

A Contribution to the Literature of Differential Photometry.

The mensuration and comparison of the illuminating value of the total spectrum of various sources of light have for a long time employed the attention of various observers; but, with the exception of the work of Prof. Pickering, there is surprisingly little known of the comparative luminosity of the small portions of the spectra of various illuminants that may, for purposes of comparison, be considered as homologous parts.

The classic Fraunhofer's curve was made with appliances and under conditions that render it useless except as a convenient diagram; still I have used it for comparison, not because I believe it to represent anything, but because everyone knows what it is intended to represent, and would instinctively compare every other curve that might be offered to it.

The Unit of Comparison.—Prof. Pickering's monograph proved conclusively that the standard candle was nearly as unfit a unit for comparison as it was possible to obtain, and it may be that this has dampened the ardor of those who started to follow the way he had so well pioneered; but as there is a standard candle it was needed to "tie the sun to a post," as the land office surveyors phrase it. The precise method to be used has puzzled me greatly, when by chance a routine question for the candle power hour value of a gallon of astral oil suggested a way.

A standard candle that was burning more than usually well was taken as the arbitrary unit, and from this the determination of a lamp was made; this was then duplicated, and the two lamps compared with care for a long time, and by this a proximate standard of comparison was obtained.

The final development of this experiment was a round-wicked kerosense oil lamp—a "night lamp," in fact, with a wick ¼-inch in diameter—which lamp set to burn to a fixed point marked on the chimney, consumed 1-10 oz. "Pratt's astral oil" per hour so completely as to leave no provable presence of unconsumed hydrocarbons.

I have, therefore, assumed as the unit for my work the lamp aforesaid, and for the purpose of comparison choose to call it a "candle power."

The Method of Curve Delineation.—The spectrum was projected for observation at such distance that the combination employed, Kirchoff-Bunsen, would represent about 270 mm., and in the diagrams annexed this is the proportion used. The precise location of the marked lines in

the sun spectrum is given, and the spaces marked with the figures were obtained by the usual scale, and then developed to the arbitrary distance chosen for the projection; this gave the Y-distances, the lengths of the parts of the spectrum. The ordinates of the curve were obtained by an arbitrary division of the scale of the interposing prisms, and as there is no possible natural scale, these X-distances were projected also in millimeters. This system of projection divides the spectral curve into a series of 27 parts whose relative areas can be determined with a certain accuracy.

The Curves Determined.—Up to this present I am willing to publish my observations only on sunlight, the ethine (acetylene) flame, and the gasoline vapor argand, both in its natural condition and whitened by a neutral chimney. It is to be noted in passing that the combustion of the ethine is complete, and that of the gasoline very far indeed from this so desired condition; the fact being that, at the temperature of the argand flame, there were present undecomposed hydrocarbons that were volatilized unchanged.

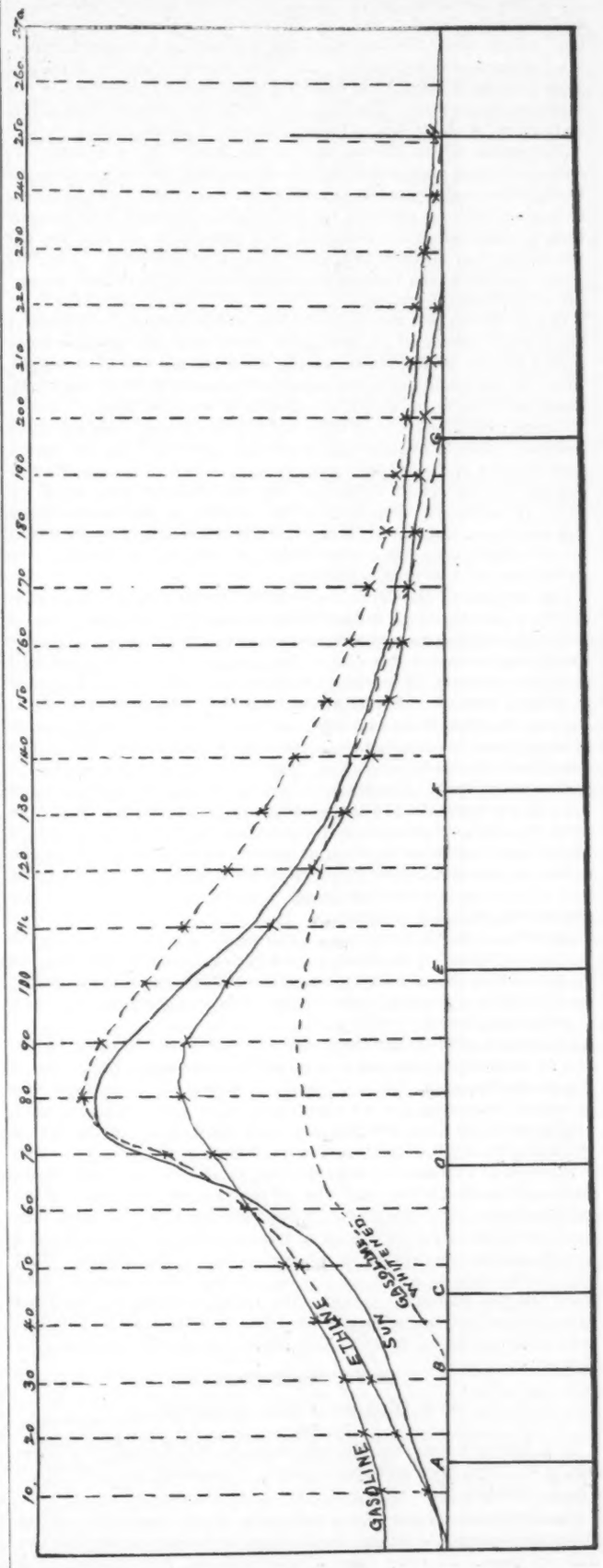
Along with these others, series of observations were made on the ordinary city gas, but the variations of the parts of this spectrum are so lawless and erratic that any attempt to show a normal curve would be misleading.

The Sunlight Curve.—If it were intended to express the value of the average illuminating power of the sun, the method of measure and delineation employed would be utterly foolish. But that was not the intention, but only to show what the sunlight might be taken to be in New York on an average day. The amount reflected from a square inch of glazed porcelain is the unit employed.

The Ethine (Acetylene) Curve.—This has a different value, and may be taken to represent, with a certain approach to accuracy, the comparative amounts of rays of every color that come from the best luminous flame of ethine which I have been able to obtain. The flame was of as pure a quality as could be obtained from a commercial sample of calcium carbide, and contained no air, and only 3 per cent. of other gases. The tip used for the burner was a "Bray," burning 1¼ cubic feet per hour; the pressure was 2 inches of water *at the burner*. The fact that the spectrum was so much more brilliant in the part between the lines *D* and *G*, was verified by a direct comparison with the sunlight reflected from the white porcelain as stated. Repeated observations made since convince me that under all ordinary atmospheric conditions in this city it must be accepted as an observed fact that the luminosity of the ethine flame is at this part of the spectrum more intense than that of any reflection of the sun's direct light that the eye will bear. By this is intended any reflection at which it is possible to look, for the space of say three minutes by the watch, without pain.

Table Showing the Differential Areas in the Spectra of Sunlight, Ethine Flame, Gasoline Air-Gas Flame, and the Same Whitened.

	Sun-Light.	Ethine Flame.	Gasoline Air-Gas.	Gasoline Whitened.
0 — 10.....	1.50	2.25	10.5	....
10 — 20.....	5.00	6.75	12.5	....
20 — 30.....	8.00	11.00	15.5	....
30 — 40.....	11.00	15.50	20.0	2.0
40 — 50.....	16.50	21.00	24.5	7.5
50 — 60.....	26.00	29.00	30.5	15.5
60 — 70.....	42.50	44.00	38.0	22.0
70 — 80.....	59.70	58.50	45.0	25.0
80 — 90.....	60.00	61.00	47.0	26.0
90 — 100.....	51.50	56.00	42.0	25.5
100 — 110.....	40.50	49.00	34.5	24.5
110 — 120.....	31.00	41.50	27.0	23.0
120 — 130.....	23.50	34.50	20.0	20.5
130 — 140	18.00	28.00	14.5	17.5
140 — 150	14.00	22.50	11.0	14.5
150 — 160.....	11.00	19.00	9.0	11.5
160 — 170.....	9.50	14.00	7.0	8.5
170 — 180.....	8.50	11.00	5.5	5.5
180 — 190.....	7.50	9.00	4.0	3.0
190 — 200	6.25	7.50	2.5	1.5
200 — 210.....	5.00	6.00	1.0	0.5
210 — 220.....	4.00	4.50	0.5	....
220 — 230.....	2.00	3.50	....	....
230 — 240.....	1.00	2.50	....	....
240 — 250.....	0.75	1.50	....	....
250 — 260.....	0.50	0.50	....	....
260 — 270.....	0.25	0.00	....	....
Total areas.....	464.95	559.50	422.0	254.0



Illumination Curves of Sunlight, Ethine Flame, Gasoline Air Gas Flame and of the Latter Passed Through "Neutral Tint" to Whiten it.

Area of the sunlight curve..... 484.95 | Area of the gasoline curve..... 422.0
" ethine curve..... 559.50 | " gasoline whitened..... 254.0

The Two Gasoline Curves.—These seem to me specially interesting, as showing the fact that, under all circumstances, the habit of "whitening" a light, under the impression that the seeming intensity is a gain, is a "progression backwards." The great excess of the red in the gasoline is an apt illustration of the loss of light from hydrocarbons of low breaking temperature. The luminosity of a hydrocarbon flame is limited by that of the carbon at the temperature of disassociation.

Discussion of the Curves and of the Table.—In comparing the curves and their areas it is to be remembered that the one given for the sunlight does not pretend to any definition of the sun's luminosity, but only to set forth the extent of the sun's light as reflected from a square inch of glazed porcelain, which has been stated to be all that the eye was able to bear for three minutes without a sensation of "pain," by which is intended the warning that to gaze longer might cause a discomfort of prolonged duration.

It was obvious that this light was less intense than that of the ethine flame which produced no analogous effect, and this appears to be caused by the predominance of the chemical rays in the sunlight, which, in the conditions of the experiment, were as 400 to 1, when compared to the ethine, as shown by exposure of sensitive films.

Curves traced for columns three and four are much more worthy of acceptance than those for columns one and two; this, for the reason that the color of the test light was the same as that of the gasoline air gas, and only a trifling difference could be observed even when the flame was whitened. Besides this, the number of observations made was numerous, and this is the mean, while of necessity the sunlight is a very variable quantity, and to obtain any rational curve that of one series only could be used in plotting.

The Relation of the Curve Areas to the Candle Power.—It is naturally very pleasing to me as an observer to note that the gross observation of the candle power of the gasoline air gas flame, 40-candle power, should come so near to the sum of the parts, 422.0 mm. area, and that that of the whitened flame should be 254.0 mm. area for a candle power of 26; but from the want of any obvious connection between them, this was judged to be a coincidence, until comparison of a large number of observations showed that the same ratio, or one strangely like it, ran through all the observations when they were reduced to the conditions needed for plotting. The condition that confronted me appeared to be this: If the momentum of the whole of the rays of light is nearly the same, to within the perception of the human sight sense, and it is, it follows that there must be the same number of rays impinging on the area of the almost invisible violet, as on the brightest yellow, if a small unit of area, say a square millimeter, is taken, and *a fortiori*, in the case of the slit of the spectroscope.

Therefore, if the instrument were well made, the opaque prism would be the most perfect of photometers, and there can be no harm, then, in the assumption that, within the conditions of this series of experiments, the sum of the differential parts divided by the unit lengths of the parts should be equal to the candle power.

If this held good the candle power of the ethine flame would be 60, and by observation, made as well as possible under the conditions, it was 64-candle power. I do not know from whence this large discrepancy comes, but suspect it is an observation error due to the excessive brightness of the flame affecting the light appreciation of the eye—a not unknown result in this department of study.

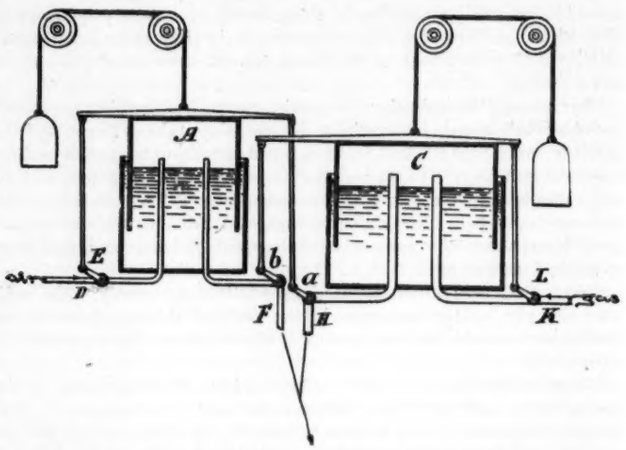
It would be a pleasure to compare these rather hurried observations with some made at leisure and when in the vein, as were those of the gasoline flame, but as the present interest in "acetylene" seems to warrant publication, they are offered, of course subject to review when a greater opportunity shall have brought a greater knowledge. Until then I offer them as, so far as I know, the only study that has been made into this interesting question—the investigation, mensuration and delineation of the comparative illuminating value of small homologous parts of the spectra of artificial illuminants, or into the light values of that of ethine at all.

The Dickerson Gas Governor.

U. S. Letters Patent (No. 550,162), issued to Mr. Edward N. Dickerson, of this city, cover an improvement in "combined gas governors." The specification is:

This invention relates to a combination of two gasholders or gas governors arranged to supply—for example, to a mingling device—two different gases. In some cases of this kind—as, for instance, when acetylene and air are to be mingled—it is important that an excess of air shall not be delivered in case of the failure of the acetylene. In order to prevent this difficulty, I have combined two governors in such a way that when either one is emptied of gas the delivery of gas from the other one is prevented.

My invention will be readily understood from the accompanying drawing, which is generally a vertical cross section.



A and *C* represent the governors, having supply pipes *D* and *K*, provided, respectively, with governing valves *E L*, and with delivery valves *b a*, connecting to pipes *F* and *H*, respectively. As ordinarily employed, the governor *A* is used to supply air, while the governor *C* is used to supply acetylene, the proportion of air being less than the proportion of acetylene. On this account the pipes *D F* are made of less diameter than the pipes *K H*. As will be seen, the valve *a* is controlled by the governor *A* and the valve *b* by the governor *C*. Consequently when either governor sinks the delivery from the other governor is cut off. Each governor independently controls the supply of gas to it. The pipes *F* and *H* may connect with any suitable mingling device.

It is evident that the mechanical construction may be varied, the principle of my invention being the interaction of the two governors.

The claims are—

1. The combination of the two governors *A* and *C*, the governor *A* connected with delivery valve *a* from the governor *C*, and the governor *C* connected with delivery valve *b* from the governor *A*, substantially as described.

2. The combination of the holders *A* and *C*, with valves *E L* and *a b*, the holder *A* governing the valve *E* and the valve *a* in the delivery pipe of holder *C*, and the holder *C* governing the valve *L* and the valve *b* in the delivery pipe of holder *A*, substantially as described.

On the Encouragement of the Small Consumer.

[A paper read by Mr. J. Holliday, of Scarborough, before the North of England Gas Managers Association.]

That there is a wide zone into which practically no advance has yet been made by gas for illuminating or any other purposes, is well known to every person who takes an interest in present day gas supply; and many of the responsible heads of various gas undertakings throughout the country have each some pet scheme whereby this unproductive area has to be caused to fructify.

One of the questions of the day, as it has indeed been more or less a question for years, is the danger of the oil lamp. With the number of deaths resulting from accidents with mineral oil lamps—reaching in London alone 9 in one week—there is little wonder that matters have arrived at an acute stage; and whatever may result from the deliberations of the Commission promised by the Home Secretary, to investigate the causes and suggest remedies, either in the way of a more perfect method of construction of the lamp itself, or by a regulation as to the quality and "flash" point of the oil, it appears to me that we members of the gas industry have an exceptional opportunity at the present juncture. My own view is that, whatever improvements may be effected in oil lamps, the source of danger itself will always be present. As the writer of a leading article in one of our trade journals succinctly put it recently, "The manufacture of small arms has been perfected and carried to such a pitch as to be almost a fine art; but when they are loaded they are as dangerous as ever they were, and so will 'loaded' safety lamps be."

The matter being so prominently before the public, it occurred to me

when asked by our President to read a paper at this meeting, that it might possibly be of interest if I laid before you briefly a sketch of a twelvemonth's actual returns from two systems we have in vogue in Scarborough for reaching occupiers of small cottage property who are almost by heredity oil burners.

Some five or six years ago a system of short accounts was introduced among small consumers; and, as far as it goes it has answered extremely well, as may be judged from the following figures taken out for the twelve months ending June 30, 1895:

Number of monthly consumers.....	271
Total consumption per annum by above....	3¼ million cu. ft. (approx.)
Average consumption per meter, about.....	13,000 cu. ft. per annum.
Bad debts on a total rental of £2,495 were...	£20.62

= .78 cent. per 1,000 cubic feet sold, or somewhat under 1 per cent. in the aggregate.

With regard to the details and conditions under which we work this system, I may explain that our gross price for gas being 75 cents per 1,000 cubic feet, with a rebate of 6 cents per 1,000 cubic feet for prompt payment, we supply our monthly consumers at the net price—that is, 68 cents per 1,000 cubic feet—without deposit or other security; the only condition being that the account is paid on presentation by the collector, or within three days therefrom at latest. Failing this, the gas supply is discontinued without further notice. No outlay is incurred beyond that of providing and fixing a meter and main tap.

This system works extremely well, and is a safe source of income in cases where the tenants are provided with house pipes and the necessary fittings, or are prepared to purchase them. But in the case of houses unprovided with fittings, it of course fails to meet the necessities of the situation. Recognizing this fact, my Directors about 18 months ago authorized me to fit up a few installations of prepayment meters, with a view to testing the possibilities of the system in Scarborough; and it is of a few of the results and experiences gained during this period that I will now speak.

The first condition imposed was that the applicant's house should not contain more than six rooms, and that the service and house pipes should be laid in. With regard to the latter qualification, however, we have found it much safer and more satisfactory to ignore it generally. As a matter of fact, in almost all the first cases we had to deal with, the pipes were found to be in a very unsatisfactory condition—leaking either from bad joints or from nail punctures. We have therefore in most cases relaid the house connections entirely from the outlet of the meter. The slight extra cost of the piping and labor certainly repays us, through having a perfect and satisfactory job to commence with. The form to be signed is of the usual type—the applicant, of course, signing the declaration as to liability for the return of the various articles in good condition, over a 12½ cent. stamp. It was decided to supply 22½ cubic feet of gas for each 2 cents, and to provide each consumer with a meter, one good slide pendant, one bracket (fitted with governor burners), and at option a small breakfast griller or a boiling burner.

We have at the present time between 350 and 360 prepayment meters in action; and out of these I have taken the first 70 which had completed not less than one full twelvemonth's working upon which to base my observations. In the return relating to these 70 meters, the first matter of significance is the great fluctuation of consumption per meter—varying from a minimum of 1,700 cubic feet to a maximum of 23,000 cubic feet per annum. In this respect the following table may be of interest to you:

2	consumers	between	1,700	and	2,000	cubic feet	per annum.
3	"	"	2,000	"	3,000	"	"
2	"	"	3,000	"	4,000	"	"
5	"	"	4,000	"	5,000	"	"
6	"	"	5,000	"	6,000	"	"
6	"	"	6,000	"	7,000	"	"
11	"	"	7,000	"	8,000	"	"
13	"	"	8,000	"	9,000	"	"
5	"	"	9,000	"	10,000	"	"
7	"	"	10,000	"	11,000	"	"
2	"	"	11,000	"	12,000	"	"
2	"	"	12,000	"	13,000	"	"
2	"	"	13,000	"	14,000	"	"
2	"	"	14,000	"	15,000	"	"
1	"	"	15,000	"	23,000	"	"
1	"	"	23,000	"	24,000	"	"

The mean average consumption per meter is equal to 8,187 cubic feet per annum—a low figure compared with the returns reported by some other companies.

As I said before, we allow 22½ cubic feet for each 2 cents; and as every installation costs us, on an average, £15 to £16.25, even this consumption leaves us with just a fair margin of return for the purpose of covering wear and tear on fittings.

With regard to the consumption per meter per month, the return is most favorable, as the same level is maintained fairly well from January to December, with the exception of March and April. This is shown by the following table:

	Cubic Feet.		Cubic Feet.		Cubic Feet.
January	662	May	507	September	685
February	601	June	591	October	841
March	474	July	731	November	934
April	452	August	834	December	875

Giving an average of 682 cubic feet per meter per month.

With regard to the meters themselves, my own opinion is that, though considerable advances have been made even during the past two years, we cannot call the system an absolute success until rather more reliance can be placed on the coin attachment not going either faster or slower than the meter index. At one of our recent monthly collections there were 51 cases where money had to be returned to the consumer, and 100 cases where it was necessary to request the consumer to pay sums varying from 2 cents to 91 cents where the cash in the box was deficient.

The number of what may be termed subsidiary complaints received at the office, and attended to, from Jan. 1 to Aug. 31 of the current year was 123; and their nature as follows:

Bent pennies and coins stuck.....	42
Complaints as to rubber connections for griller.....	20
Foreign and silver coins used.....	8
Stoppage in fittings and other repairs	53

In the case of the item "foreign and silver coins used," I may mention that the meter had in one case been put to a use never contemplated, I feel sure, by the makers—viz., for the purpose of a savings bank; the good lady having inserted four 50-cent pieces into the box in place of 8 cents, so that they would be, for some time at any rate, safely under lock and key. The majority of the complaints named above are due to the insertion of bent pennies, and people being nervous when they are putting the coins in, and consequently allowing them to fix. Another point is that very few people will prepay more than 4 or 6 cents' worth at once; and, unfortunately, with most of the meters we have had experience of, we find that, unless something like the full complement of coins is inserted together, the attachment index and the meter index beg to have different views on the situation.

Before sending out any meter, we run it through a test, in the first instance to see if the valves are closed; it is then attached to the test holder and a gas fire, and 8 cents inserted in the slot. The amount to be consumed at the rate of 22½ cubic feet per 2 cents is therefore 90 cubic feet; and they are allowed to pass if they do not give less than 83 or more than 93 cubic feet for the 8 cents. If not within these limits, they are rejected. The following table shows the results of 356 tests made with five different makers' meters on these lines:

	Meters Tested.	Number Rejected.	Per Cent.
A.....	213	13	6.10
B.....	31	1	3.22
C.....	56	4	7.13
D.....	28	2	7.13
E.....	14	1	7.13

One interesting fact in connection with the introduction of coin meters into Scarborough is that houses in older parts of the town, which years ago were the domiciles of the more affluent members of the community, and fitted up with gas, but which, owing to the march of events and extensions of the town, have been on the down-grade and left to the fisher-folks, have, after a lapse of 20 to 25 years, again become illuminated through the agency of the "penny-in-the-slot" meter.

That the principle of the prepayment meter system is undoubtedly right, and that, as far as it has gone, the gas world has scored a distinct success with it, appears to me to be indisputable. What we now require is to have the details rather more fully perfected, so that the troublesome readjustments with the consumers at present necessary may be done away with. I feel sure that, with the adoption of a broad and generous policy, we shall be able to make the use of oil quite unnecessary, and that gas will become not only the universal light in the class of property under consideration, but that it will also become the medium of all their culinary operations as well.

That, in my own town at least, there is plenty of scope, is evident, as out of 9,000 inhabited houses in the borough we only number at the

present time some 5,133 as gas consumers; and I have no doubt whatever the large proportion of our other towns are in much the same position in this respect.

Discussion.

The President said the subject of the paper was now before them. It was one upon which many of them had had experience—both with penny-in-the-slot meters and in the encouragemeut of small consumers in other ways.

Mr. H. Tobey (Malton) had listened with much pleasure to the paper Mr. Holliday had given them, and the interesting details in it. Mr. Holliday began by speaking of the benefit which was likely to accrue to humanity by the adoption of the penny-in-the-slot meter, on account of its being free from the dangers of the oil lamp. The danger of oil lamps was very great indeed. He saw by the report of the Metropolitan Fire Brigade, recently issued, that the number of fires occurring from lamp accidents in London alone was something like 450 a year. The number of lives lost amounted to about 33. Of course, this did not include a great many of the minor casualties which occurred, but were all the cases which were reported to the Fire Brigade and dealt with by them. There must, however, be a vast number of cases which never were reported—small accidents which did not come before the Fire Brigade. He thought they might take these as at least double the number reported; so that the total would be about 1,000 in London in one year. If these accidents could be decreased by means of the use of gas through penny-in-the-slot meters—and most of such accidents occurred in small dwellings—no doubt the loss of life and property arising from lamp accidents would be very much less. He had had some experience himself with prepayment meters. He must say that with the meters with which he was first supplied he had some difficulty; but with those he was now getting he had not the same difficulty. The meters were now so improved that he thought they could be used without incurring much annoyance, either from pennies getting fast or people getting gas for, perhaps, two or three days, or longer periods, and they not being aware of it, and then having to ask the consumer to pay up the difference, which was always a matter of annoyance. He had formerly known a consumer put in six consecutive pennies before he was able to get a supply of gas; but now the improvements in construction of the meters enabled them, he thought, to rely upon the meters giving the exact quantity of gas for which they were rated. He found that the average consumption per meter was something like 10,000 cubic feet per annum. This was not a very large quantity; but still he thought it was a quantity which paid. Of course, the extra rate charged should be sufficiently high to yield a return for the extra cost of the meter and the cost of the service to the small consumer. Their charge for gas at Malton was 75 cents per 1,000 cubic feet, and they rated the gas supplied by prepayment meters at 25 cubic feet for 2 cents, which was 83 cents per 1,000 cubic feet. But he should remark that, in addition to this, they did not charge meter rents to ordinary consumers, which was equal to about 4 cents more. So that, really, the difference between the two rates would amount to about 12½ cents per 1,000 cubic feet. Of course, there were consumers and consumers; and what might be considered a large consumption in one place might very well be reckoned small in other places. He found, in his own case, that the average consumption per meter was about 30,000 cubic feet per annum. Some might not consider this as large, but in districts like theirs, they reckoned that 30,000 cubic feet was a considerable consumption.

Mr. E. H. Millard (Durham) said he had listened with great pleasure to the paper; and he was only sorry that the title did not lead them to infer that the prepayment system was to be referred to; otherwise he should probably have been prepared with some details on the subject. He thought that perhaps Mr. Holliday had some new system which he was to enlighten them upon; but he found it was the well-known penny in-the-slot meter which stood in the foreground. With respect to monthly consumers, he might say that, before going to Durham, he had a very similar system at work. He used to collect every fortnight; and those consumers were charged the same price as the ordinary ones. In approaching this question, it was evident they must take into consideration the cost of producing the gas, as well as the selling price. In this he thought, lay the whole *crux* of the question. Some of the engineers of large works had been twitted with not being up to date with the prepayment system. He confessed himself that, if he was selling gas at (say) 62½ cents he should be chary of going in for either prepayment meters or monthly collections, unless there was a considerable margin. He had worked out the number of consumers and the consumption for several works, confined to the county of Durham; and he was surprised to find that, in taking out the leakage, the leakage per consumer ranged very high. They were all agreed, he thought, that the leakage question was largely dependent upon the services; and he did not think they lost more, per service, with the large consumer than they did with the smaller one. Therefore, the leakage, which amounted, on an average, to about 2,500 cubic feet per service per annum, was large. Wrought iron services would give way; and they might expect the leakage to go on. He did not know whether Mr. Holliday made a separate charge for meter rent. With the small consumers, it was quite evident that the 20 cents per 1,000 feet extra alone would not cover that. He saw that Mr. Holliday had had to come round to fitting up the houses. He did not think the automatic supply system, without the companies taking up the gas fitting, was worth anything at all. Another point which was well brought out in the paper was that, without a griller, a penny-in-the slot meter was not worth much to Mr. Holliday, as would be seen from the large consumption he obtained during the summer months. With regard to the money not tallying with the meter registration, he did not know whether it was altogether wise to insist upon the few extra coppers being paid, or to give the consumers back the few coppers which were in excess. He was afraid that any such policy would tend to destroy the confidence of the user in the penny-in-the-slot meter. Although at Durham they had had experience of both too little and of too much money, they had not yet instituted the principle of charging two cents for two cents worth of gas. The idea as to making the money box a savings bank, he did not think would be strange. They frequently found that a 50-cent piece had been dropped in for two cents; but the consumer alway knew that he had put it there. He found himself very much in agreement with Mr. Holliday in his paper. The only thing he had doubt about was whether even 18 or 20 cents per 1,000 cubic feet was sufficient to cover the difference between supplying small consumers, on account of the low average consumption, and the leakage they would have per consumer.

Mr. J. Hall (West Pelton) said that, with regard to the leakage which has been referred to, it had not yet been explained how it arose. Was it from the time the penny was put into the slot till the meter started again that it went on? He had had no experience in the matter. If there were a waste on that account, it would be judicious on the part of gas companies to make their charges so as to cover any such loss.

The President said he did not think the intention of the paper was to raise a discussion upon leakage. Mr. Holliday, he thought, referred to leakage in connection with the difference between the amount of money in the box and the quantity of gas consumed. It was not so much a question of leakage in the services as of the difference between the coin put in and the quantity of gas used. But let them discuss the matter in a general way. He knew that a good many gentlemen had adopted the prepayment system, and some of them had had considerable experience with it; and he hoped they would take this opportunity of stating what they knew about it.

Mr. Tobey said he would just like to add the fact that the number of consumers in Malton had increased by 20 per cent. since they adopted the penny-in-the-slot meters.

Mr. J. Whyte (Seaham Harbour) said his experience with prepayment meters was not very great, but such as it was he should be very pleased to lay it before the Association. He had somewhere about seven dozen of them at work. With reference to the discrepancy between the cash and the quantity of gas consumed, he had had some difficulty in that way. In the case of one or two meters, which were the first fixed, the gas and money agreed to a penny piece. But he had given back as much as 16 cents and 18 cents; and in one instance they were about 93 cents short. In that case he simply took out the meter, and said nothing about the matter. His conviction was that if they once said the meter was wrong, it would be altogether condemned by the people; and he considered that the best and easiest way out of the difficulty was to lose the 93 cents. He wanted to try to press the business a little. This summer they had been at considerable expense in laying down plant for the public lighting of a neighboring parish; and he meant to try to push business there. He proposed to put in the fittings. He knew that in some cases they would lose as much as 30 or 36 cents, and in other cases they would make a few coppers. But his contention was that they ought to get in prepayment meters, and obtain an increased consumption. They charged only 6 cents extra for them. Their price to ordinary consumers was 87 cents per 1,000 cubic feet, with no meter rents; and with prepayment meters, their charge was 93 cents.

Mr. T. Bower (West Hartlepool) said he could not add anything to the discussion in the way of experience; but he was exceedingly glad to have had the pleasure of listening to the points that had been put before the meeting. In his town, they had done nothing whatever in the way of adopting prepayment meters; but he was inquiring into this,

and the matters mentioned that day would be of use to him. He once had some experience with "slot" meters; and one of the things he found was that the money did agree with the gas consumed. In one or two cases, when they asked for the balance, they were told to take out the meter; but the suggestion was made that, if the consumers were satisfied with the gas consumption except on the point in dispute, they would take out the penny-in-the-slot meter, and put in an ordinary one at a reduced price. This brought them several new consumers; and for them, credit ought really to be given to the penny-in-the-slot meters. If meter makers would now turn their attention to making these meters more perfect, there was a wide field for them. He had no doubt the makers would do what they could. He was sure they were all very much indebted to Mr. Holliday for bringing his experience before them; and he believed they might profit by it when the time came for taking up the matter.

Mr. Whyte said he would like to add that in some cases consumers had to put in from 8 to 12 cents before they had any gas.

Mr. J. H. Penney (South Shields) considered they were very much indebted to Mr. Holliday for the facts he had placed before them with reference to encouraging small consumers. He thought that one very important phase of the question for most of them was, seeing that the electric light might, sooner or later, claim many of their larger consumers, such as manufacturers, they should do all they possibly could to get hold of the smaller consumers. No doubt these, along with the middle classes, would be the backbone of their rental; and he regretted to learn, from Mr. Holliday's paper, that the prepayment meters were not such a great success as they were led sometimes to believe them. The fact that the prepayment meters showed such variations as he had mentioned was not satisfactory at all. He thought that the letting out, free, of a ring burner or a simple gas bracket, to small consumers, would be of great advantage. They generally found that the rental to a poor consumer was a great bar to his commencing the use of gas; but if they "wrapped it up," in some way or other, with the price, he had no doubt at all that these people would adopt gas. By so doing, gas suppliers would add to their receipts. They had had no experience with prepayment meters at South Shields; and therefore he was sorry that he could not add anything more to the discussion.

Mr. Millard said he should like to supplement his remarks with one point. The grillers which they supplied along with prepayment meters had been so much appreciated by the consumers that they had come to consider that they could not have a griller without a prepayment meter, and they asked to have their own grillers exchanged so that they might get a prepayment meter. In order to meet their views he brought the matter before his Directors, and suggested that they should fix the grillers and make a charge of 12 cents per half year for them. They had now a large number of these grillers out, solely through the penny-in-the-slot meters advertising them. He might say that they invariably put the gas fire down by the side of the fireplace, resting on the fireplace during the summer, and any fumes that came from it went up the chimney. He thought it might be worthy of the consideration of any of them whether they should not adopt the method of hiring out grillers, and charging 12 cents per half year for fitting them up.

Mr. W. Ford (Stockton) said he really would not have risen, unless it had been to confirm an expression of opinion by Mr. Penny. In his town, he was sorry to say, the electric light in large works was superseding the use of gas to some extent, and, though they were a corporate body, he was afraid they would not be permitted to do as their friends did at Durham and Seaham Harbour, in introducing gas fittings. Corporate bodies were subject to the ratepayers, and ratepayers sometimes indulged in such reflections as, "He may supply the gas, but not the fittings." That might have some effect upon the introduction of penny-in-the-slot meters. A working man might find a griller a very useful thing to have, in enabling him to get something hot before he went out in the morning; and especially if his wife were ill. Penny-in-the-slot meters seemed to be condemned—he thought rather hardly—by Mr. Holliday; but it was a new industry, introduced very recently. The manufacturers of the meters had displayed a great amount of ingenuity in their construction; and they must have a little patience with them. Give them time to perfect the instrument, and he had no doubt that, before a few years had passed away, the penny-in-the-slot meter would be quite as reliable as any meter they now had. He was very sorry indeed he could not add anything to their experience. About five years ago, his Corporation authorized him to introduce the penny-in-the-slot meter. He did that by advertising. He put the meters into every plumber's shop in town, with a large placard stating that they could be had at the gas works, free of charge—no meter rent and all connections made free. Yet, notwithstanding that this advertisement continued for 12 months, the total applications made to the Gas Department were for only three meters. One of them was returned on change of tenancy; another was sent back because it was too much trouble to put the penny in the slot, and an ordinary meter was demanded; and the third one, he was sorry to say, broke down. He thought, as had been said, that where gas was cheap—say, 50 cents per 1,000 cubic feet—there was not that inducement to corporations or companies to persevere with the introduction of prepayment meters, because, if the production of gas were at the maximum, and they increased the output by these meters, they would have to enlarge the works to supply the small consumers. He was very pleased indeed that Mr. Holliday had shown so clearly to them that the rising generation were not going to be behind those of them who had passed through the greater part of their experience; and he wished all their young friends every success.

Mr. J. Coates (Ottawa) said he had no right to speak, because he was not a member of their Association. He had come from Australia, and he was now manager of a large gas works at Ottawa. He should like to ask the reader of the paper, or some member of the Association, what the experience was with those who would not pay. If they cut off a man's supply of gas, he took to electric light; but if they just said to him, "We will not supply you with gas on the ordinary terms, but we will put in a prepayment meter," he would be bound to pay. He did not know if they had any experience of this kind—whether they had tried it upon consumers who could afford to pay but would not. He was fighting three electric light companies at Ottawa, and was doing well; so that, if gas could beat them on the water power question, surely they could beat them on the coal.

Mr. Tobey said that, when they found a consumer who would not pay, they gave him the option of two things—he must either make a deposit, or he might have a penny-in-the-slot meter; and he would not have any more gas unless he accepted one of these alternatives.

The President, before calling upon Mr. Holliday to reply to the discussion, made a few remarks. He thought the title fully bore out the text of the paper. The encouragement of the small consumer naturally suggested, in the first place, the penny-in-the-slot meter, although it did not confine itself to that. He noticed that Mr. Holliday's average sale of gas per meter was about 8,000 cubic feet per annum. This corresponded very nearly with his own experience. They had something like 120 of these meters in use, which was about 16 per cent. of their total consumers. Last year they had an average consumption with these meters of 7,500 cubic feet. This year there had been an increase, and he thought the average might now be quite 8,000 cubic feet. This increase was due to the introduction of more cookers. When they introduced the system, they let out grillers on hire; and he quite agreed that, without letting out fittings and some appliance for cooking, the penny-in-the-slot meters, in small towns, could not make much headway. The meters had been the means of advertising cookers and other methods of consuming gas, as had been mentioned by himself already, and by another speaker. At the time of introducing the system they had a number of old cookers, which had probably been in use for nine or ten years, and which it was difficult to let out, as people preferred to have new ones. The penny-in-the-slot meters enabled them to place them in the district; and in this way they had been very lucrative for them. He had now gone beyond this, and had put in a few new cookers of small size; and he was disposed to think that the more they went in for the supplying of gas cookers to the smaller class of consumers, the more they would benefit. He thought they had a wider range than Mr. Holliday; but he did not intend to have it long. If they did not go beyond 2,000 cubic feet per annum, he thought they were hardly worth the capital outlay involved, and they should take the meters out and place them where they would be more remunerative. As to the reliability of the prepayment attachment, he was very glad that Mr Ford had spoken about it. There was no doubt that prepayment meters had been hurried on the market—not so much by the meter makers as by the demand; and there was no doubt, too, that the meters were not perfect. But they were improving rapidly. Each series of meters which came out from the various works was an improvement on what had gone before, and he believed they would soon reach to a system of perfection as near as possible. They were allowed a range of 5 per cent. with ordinary meters, and they were told that the range for prepayment meters only went up to about 7 per cent. These were the points he wished to emphasize before getting Mr. Holliday to reply, and he would now ask them to accord to the author a very hearty vote of thanks for coming forward with his paper.

Mr. Holliday, in reply, said that with regard to what had been taken as adverse criticism of the prepayment meter, he was sorry if his paper

had given such an impression, because he could say that nothing was further from his mind than to do so. He believed that the prepayment meter was one of the things they should forward as much as they could. All he had said he had based, as far as he could, on facts. There was no doubt that as soon as the makers of meters had had time to perfect them more—and they were doing so every day—they would get a thing of practically automatic working. With regard to the returning of money, or the asking for more money, they in Scarborough came to the conclusion that the best thing to do was to let the matter run for three months before adjusting the money. If there was more money than there should be in the box at the end of the first month, they informed the consumer, but left it in; if there was less money, they told him, equally, that there was not enough in, but left it. In the bulk of the cases it righted itself by the end of three months, and they did not trouble themselves with demanding payment if it did not. On the question of waste, he might say that it was not waste, but simply a question of the quantity of gas consumed and the amount of the coins not tallying. Of course, there was no waste so far as the gas itself was concerned. As to the introduction of penny-in-the-slot meters in cases of bad payers, they found these meters worked very well indeed. In a great many instances, with ordinary meters, they were called on to put pressure upon consumers, quarter after quarter, to get the money in; and they had had in this way to put penny-in-the-slot meters into houses larger than they had ordinarily to deal with in their town.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, November 9th, 1895.

A Gas Explosion in London.—Stealage of Gas.—The Incandescent Burner.—Municipal Trading.

A very remarkable accident, the exact cause of which is not yet ascertained, but which is supposed to be due to an explosion of coal gas, occurred in London on Tuesday week. The scene of the disaster is a narrow court or passage branching off from the well known thoroughfare named "The Strand," not far from Drury Lane Theater. The neighborhood is poor, and the houses, which are old and rather dilapidated, are occupied by the laboring classes. Two or three residents had noticed a smell of gas, but no special attention appears to have been directed thereto, beyond the casual remark that it ought to be seen to. But about 7 o'clock in the evening there was a loud report and outburst of flame, attended with the entire collapse of one house, No. 27, and portions of the adjoining premises. A great deal of damage, breakage of glass, etc., was caused in the immediate neighborhood by the shock, and the whole occurrence was so sudden that none of the occupants could escape or even attempt to descend the stairs. Some were carried bodily from the third or fourth floor with the ruins. Looking at the closely populated and busy character of the neighborhood it is surprising that nobody was actually killed. Twenty-seven persons were conveyed away to hospitals on account of more or less serious injuries, but none were considered to be dangerously wounded. A few hours later, however, while the firemen were engaged in shoring up neighboring walls and clearing the ruins, a further collapse occurred, burying two men, one of whom was extricated speedily and found to have sustained no serious injury, but the other could not be removed for 10 hours. He was terribly crushed, and though at first it was hoped that he might recover, he died in a short time. Proper inquiry is being held, the result of which is not yet published. So at present it remains an open question whether such wide spread wreckage was the result of an unusually violent explosion, or of a comparatively mild explosion acting upon old, dilapidated and possibly none too strongly built property. Some parts of the collapsed house were already uninhabited, and perhaps it may turn out to have been incapable of standing a shock that under other circumstances would simply have blown out a door or window. However this may be, it appears that the walls of No. 27 were started out by the explosion, to an extent sufficiently wide to let down the upper floors and roof, the fall of which would necessarily involve adjoining buildings in its destruction. There has not been an accident of such magnitude in connection with coal gas since the Tottenham Court Road explosion which occurred 15 years ago.

An extraordinary case of stealage of gas has just come to light at Aberdare in Wales. The landlord of a public house, having observed that the pipe leading from the main to the meter was carried under a passage between his own and the next house, one service supplying the two premises by means of a branch thrown off on each side, called in the aid of a gasfitter, and cunningly contrived a connection or by-pass from the service to the outlet side of the meter, in such a manner that it was not visible in the cellar where his own meter was situated, nor yet from that tenanted by his neighbor's meter. In order to further avert suspicions, this pipe was not too large, being only 5-16ths bore. This device had been in use for three years, and was discovered by the meter inspector at Michaelmas last, who lit the gas in the cellar to read the index, and then found that the jet continued to burn after the main tap was shut off. Strange to say, the gas company were advised that they could not proceed against the party who actually made the connection, on the ground that the offence was committed more than six months since. If this is a correct reading of the law there is room for amendment, as the doctrine that any illegal act can be condoned by a lapse of six months is mischievous, especially in such a case as this where the odds are against detection in that period. So far as can be ascertained from the company's books, the result of this trick was a saving to the consumer of 6,000 cubic feet per quarter, as calculated upon the previous consumption, but it is probable that the actual quantity of gas taken was considerably more. Fortunately for himself, the publican was able to pay for good legal advice, so the matter was adjusted without any personal inconvenience. We pride ourselves frequently on the fact that there is not one law for the rich and another for the poor in this country. But there is certainly one way of administering the law for the man who is able to pay for good legal advice, and another for the man who is not. So when the case came before the magistrates, the defendant pleaded guilty to connecting a pipe to the service without the consent of the gas company, and to unlawfully and fraudently abstracting gas, and escaped with a payment of £5 fine, in addition to £30 for the estimated value of the gas. It is fortunate that gas was selected as the article to be "unlawfully and fraudulently abstracted." Had anything else have been chosen, the act would have been called "stealing," and all the ingenuity of counsel might not have been able to save the landlord from a temporary visit to one of the residences set apart by the government for the accommodation of thieves and other vagabonds. So far as gas companies are concerned, the settlement is not at all satisfactory. It is probable that the publican has made money out of the transaction, and that he has obtained gas enough to represent the whole costs inclusive of his expenses. The moral of the thing is not to allow service pipes to pass under passages or in out of the way places where they can be tapped without the action becoming apparent to the companies' servants. For a slight fine is not a sufficient deterrent to dishonest persons, especially as the offence is easily committed and not easily detected. Especially is this so when it is remembered that the gas company are bound by the meter. They can change and test the meter as often as they like, and control the service pipe, but beyond that they have no control whatever, and the consumer can refuse any information as to number of lights in use, whether gas fires are fitted, or gas cooking ranges. This is a state of things that should be altered, as it is hard on the suppliers of gas, in cases of disputed accounts, to be unable to get any information beyond that furnished by the meter.

We have been abruptly reminded that the winter is upon us by a week of frosty weather, which was advantageous in the coke yards, if it trod rather too closely upon the tail end of the summer repairs and renewals. Evidently a notable feature of the coming season will be the extended use of the incandescent gas burner, which has now established itself in high-class shops, drawing rooms, and generally for superior lighting. One peculiar effect that is traceable to its general use is dissatisfaction with the ordinary flat-flame burners and a disposition to quarrel with the quality of the gas. People sit at the theater or the club under the brilliant glare of the incandescent mantle, and then go home and sit down to read the paper under a homely 5-foot flat-flame, and of course the light afforded by the latter appears dull and yellow, and so it is said that the gas is bad. And the British gas consumer is usually willing to echo a cry of "bad gas" or "dear gas" without very close attention to the real points at issue. Although the remarkable economy in consumption of gas that is secured by the use of the incandescent system might be expected to tell on the output of gas, I am not able to hear of any instance where it has actually done so. For one thing, incandescents cannot be turned to a glimmer. There is always the full power or nothing. But the real explanation is that the incandescent burner is not displacing ordinary flat-flames alone, but electricity, oil, and other modes of lighting. One incandescent certainly uses less gas than one batswing or fishtail, but two or three will use more; and it is evident which is better for the company's real interests.

But the new system of gas lighting is not without its defects. It requires about 50 per cent. more pressure than other burners, and its delicate apertures call for proper cleaning. It therefore falls foul of the average gasfitter's unaccountable predilection for ¼-inch compo. pipe, and of the average consumer's equally unaccountable objection to ordinary cleanliness in respect to his gas burners. We cannot explain

why the gasfitter objects to proper sized pipes, or why the consumer will not even give his burners a wipe round with a duster, but they are difficulties that we all have to reckon with. So troubles are already arising due to accumulations of dust and dirt. In places where dust is frequently blowing about, the burner must be regularly and carefully cleaned. Given a low pressure due to the throttling effect of 20 or 30 feet of ¼-inch pipe, together with a fair coating of dust and dirt, and the burner is no longer the thing of beauty that it was at first. A great step in maintaining its popularity will be gained by insisting on ample sized supply pipes, certainly not less than ⅜ inch in the bore, and by illustrating the loss of pressure caused by even a very short length of small pipe. Compo. pipe is now so cheap that there is no excuse on the score of economy for haggling over the size of the pipe, and it is easier to make a sound and gas-tight job with the medium than with the smaller sizes.

"Has a corporation any legal right to engage in plumbing work, as in the case of Sheffield, who made a profit of £1,300 last year?" This important question was submitted for consideration at a recent meeting of the Master Plumbers' Association of Great Britain and Ireland, held at Manchester, and its importance rests, not on the matter of plumbing, but on the right of corporations to engage in private trade of any kind, and with the special advantages they possess, to enter into competition with private tradesmen. If the corporation of Sheffield secure the order for the gasfittings for a church or a row of shops, it stands to reason that some private tradesman has lost the same. The question was discussed at length, and the President, in introducing it, said that the plumbers of Manchester suffered great injury from the competition of the corporation, and added that there was no corporation in the country that did not interfere with the plumbing trade. A gentleman from Sheffield said that when the corporations laid themselves out for such work they practically secured a monopoly of it, as they had such advantage over ordinary tradesmen. He did not believe there was any legal justification, and remarked that a previous Mayor of Sheffield had once assured a deputation of unemployed that no corporation was entitled to do work at a profit. At Bolton, it was stated by another speaker, the corporation carried out gasfitting so successfully that not a single piece of gaspipe could be seen at any of the plumbers' shops in the town. Subsequently it was decided to obtain counsel's opinion on the case of Sheffield. Possibly the raising of this question may direct attention to the larger and more important one of how far it is justifiable for municipal corporations to go in the matter of competing, not only with particular tradesmen, but with general private enterprise. When their right to enter upon trading operations of any kind is admitted, it is difficult to limit the length to which they may go. If they own the gas works, for instance, they naturally expect to enjoy all the advantages afforded to a private company, and if anything to have more. If they can sell a cubic foot of gas at a profit, why are they not to sell a foot of compo. pipe? It is very difficult to define what interferes with private trade or what does not, but anything in the way of municipal trading must affect private enterprise. Anything affecting the small tradesmen is possibly more important, because it is a matter of taking away his bread and butter, as he has a struggling time of it, what with one thing and another. The capitalist may have plenty of other resources, while the tradesmen have none, but the principle involved is the same, whether it affects capitalist or tradesman.

The Supreme Court Decision in the Case of the Sawyer-Man Lamp.

The main points in the opinion of the United States Supreme Court in the Sawyer-Man case, which was written by Justice Brown, declare that the two main defences of the Sawyer-Man patent are (1) that it is defective upon its face, in attempting to monopolize the use of all fibrous and textile materials for the purpose of electric illumination; and (2) that Sawyer and Man were not in fact the first to discover that these were better adapted than mineral carbons to such purposes.

Is the complainant entitled to a monopoly of all fibrous and textile materials for incandescent conductors? If the patentees had discovered in fibrous and textile substances a quality common to them all, or to them generally, as distinguishing them from other materials, such as minerals, etc., and such quality or characteristic adapted them peculiarly to incandescent conductors, such claim might not be too broad. If, for instance, minerals or porcelains had always been used for a particular purpose, and a person should take out a patent for a similar article of wood, and woods generally were adapted to that purpose, the claim might not be too broad, though defendant used wood of a different kind from that of the patentee. But if woods generally were not adapted to the purpose, and yet the patentee had discovered a wood possessing certain qualities, which gave it a peculiar fitness for such purpose, it would not constitute an infringement for another to discover and use a different kind of wood, which was found to contain similar or superior qualities. The present case is an apt illustration of this principle. Sawyer and Man supposed they had discovered in carbonized paper the best material for an incandescent conductor. Instead of confining themselves to carbonized paper, as they might properly have done—and, in fact, did in their third claim—they made a broad claim for every fibrous or textile material, when in fact an examination of over 6,000 vegetable growths showed that none of them possessed the peculiar qualities that fitted them for that purpose. Was everybody then precluded by this broad claim from making further investigation? We think not.

The injustice of so holding is manifest in view of the experiments made, and continued for several months, by Mr. Edison and his assistants, among the different species of vegetable growth, for the purpose of ascertaining the one best adapted to an incandescent conductor. The opinion then gives an account of the experiments made by Edison and concludes that it thus appears very clearly that there is no such quality common to fibrous and textile substances as makes them suitable for an incandescent conductor, and that the bamboo, which was finally pitched upon, and is now generally used, was not selected because it was of vegetable growth, but because it contained certain peculiarities in its fibrous structure which distinguish it from every other fibrous substance. The question really is whether the imperfectly successful experiments of Sawyer and Man with carbonized paper and wood carbon, conceding all that is claimed for them, authorize them to put under tribute the results of the brilliant discoveries made by others.

Decisions are quoted in support of the principle that if a patent description is so vague and uncertain that no one can tell, except by independent experiments, how to construct the patented device, the patent is void; and applying this principle to the patent under consideration, it is asked how would it be possible for a person to know what fibrous or textile material was adapted to the purpose of an incandescent conductor, except by the most careful and painstaking experimentation. If, as before observed, there was some general quality, running through the whole fibrous and textile kingdom, which distinguished it from every other, and gave it a peculiar fitness for the particular purpose, the man who discovered such quality might justly be entitled to a patent; but that is not the case here. An examination of materials of this class carried on for months revealed nothing that seemed to be adapted to the purpose; and even the carbonized paper and wood carbons specified in the patent, experiments with which first suggested their incorporation in the patent, were found to be so inferior to the bamboo, afterward discovered by Edison, that the complainant was forced to abandon its patent in that particular, and take up with the material discovered by its rival. Under these circumstances, to hold that one who had discovered that a certain fibrous or textile material answered the required purpose should obtain the right to exclude everybody from the whole domain of fibrous and textile materials, and thereby shut out any further efforts to discover a better specimen of that class than the patentee had employed, would be an unwarranted extension of his monopoly, and operate rather to discourage than to promote invention. If Sawyer and Man had discovered that a certain carbonized paper would answer the purpose, their claim to all carbonized paper would perhaps not be extravagant; but the fact that paper happens to belong to the fibrous kingdom did not invest them with sovereignty over this entire kingdom, and thereby practically limit other experimenters to the domain of minerals.

In fact, such a construction of this patent as would exclude competitors from making use of any fibrous or textile material would probably defeat itself, since, if the patent were infringed by the use of any such material, it would be anticipated by proof of the prior use of any such material. In this connection it would appear, not only that wood charcoal had been constantly used since the days of Sir Humphrey Davy for arc lighting, but that in the English patent to Greener and Staite, of 1846, for an incandescent light, "charcoal, reduced to a state of powder," was one of the materials employed. So, also, in the English patent of 1841 to De Moleyns, "a finely pulverized boxwood charcoal or plumbago" was used for an incandescent electric lamp. Indeed, in the experiments of Sir Humphrey Davy, early in the century, pieces of well burned charcoal were heated to a vivid whiteness by the electric current, and other experiments were made which evidently contemplated the use of charcoal heated to the point of incandescence.

Mr. Broadnax, the attorney who prepared the application, it seems, was also of the opinion that a broad claim for vegetable carbons could

not be sustained because charcoal had been used before in incandescent lighting. There is undoubtedly a good deal of testimony tending to show that for the past 50 or 60 years the word "charcoal" has been used in the art, not only to designate carbonized wood, but mineral or hard carbons, such as were commonly employed for the carbon pencils of arc lamps. But the court thinks it quite evident that, in the patents and experiments above referred to, it was used in its ordinary sense of charcoal obtained from wood. The very fact of the use of such word to designate mineral carbons indicates that such carbons were believed to possess peculiar properties required for illumination, that before that had been supposed to belong to wood charcoal.

The court considers it has not found it necessary in this connection to consider the amendments that were made to the original specification, upon which so much stress was laid in the opinion of the court below, since it unanimously agrees that the claims of this patent, with the exception of the third, are too indefinite to be the subject of a valid monopoly.

As these suggestions are of themselves sufficient to dispose of the case adversely to the complainant, a consideration of the question of priority of invention—or, rather, of the extent and results of the Sawyer and Man experiments, which were so fully argued upon both sides, and passed upon by the court below—is stated to be unnecessary and the decree of the Circuit Court is affirmed.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Middletown (Conn.) Gas Company has secured for its business offices the rooms formerly occupied by Mayor Vinal.

THE annual meeting of the Bay State Gas Company was held at the Company's offices in the Central National Bank building, Wilmington, Del., on the morning of November 19, Mr. J. Edward Addicks presiding, with Mr. W. H. Miller in the Secretary's place. The Directors chosen were: J. Edward Addicks, James G. Shaw, J. Frank Allee and John H. Bateman—two others were chosen, but as they were undoubtedly dummies, in that they immediately resigned from the Board, their names are of no consequence. It is understood that the vacancies are to be filled "by the representatives of Companies for the control of which negotiations are now pending." The negotiations likely concern Companies doing business in Buffalo, N. Y. The Board re-elected the officers who ruled last year, and the "stockholders" adopted the following resolutions:

"*Whereas*, The remarkably broad charter of the Bay State Gas Company was secured for the purpose of purchasing, owning and managing a large number of the most profitably operated gas plants in the United States; and,

"*Whereas*, Since the original acquirement of the control of the several Boston Gas Companies this policy has not been developed; and,

"*Whereas*, The time has now arrived when the policy of increasing the ownership by this Company of valuable gas plants is both practicable and desirable, and negotiations to that end having been undertaken by the Directors of this Company, it is

"*Voted*, That the Board of Directors of the Bay State Gas Company are hereby authorized to issue and use such stock as is provided by its charter, and such obligations of this Company as said Board shall deem necessary to carry out the policy of receiving ownership or control of such gas corporations as said Board of Directors shall deem desirable."

THERE is a movement on foot in Springfield, Ohio, tending towards obliging the Springfield Gas Light and Coke Company to sell its product at a rate not to exceed $1 per 1,000 cubic feet. This item puts us in mind of the fact that the gas interests of Ohio are to be congratulated over the election of Gen. A. S. Bushnell, President of the Springfield Gas Light and Coke Company, to the Governorship of the Buckeye State. The General is every inch a man, no matter how you take him. Wherefore we might add that not only the gas men but every other interest and citizen of Ohio are to be congratulated at his election.

THE oft-adjourned forced sale of the Saratoga Springs (N. Y.) Gas and Electric Light Company, on a judgment obtained by the New York Security and Trust Company, amounting to over $300,000, was formally brought off about a fortnight ago. The property was bid in by Mr. Lafayette B. Gleason, representing a committee of the bondholders, for $100,000.

A FIRE in the plant of the Creston (Ia.) Gas Light Company caused damage amounting to $300.

SOME days ago Mr. John S. Chambers, the estimable Manager of the Trenton (N. J.) Gas Light Company, had a narrow escape from fatal poisoning, as also did his wife. Their prostration was caused by the partaking at the breakfast meal of wheat cakes over which honey had been spread.

THE Gas Consumers' Association, of New Jersey, have filed articles of incorporation, the certificate asserting that the capital stock is $200,000, of which one-half per cent. is paid in. The incorporators are: Charles F. Leavenworth, Washington, D. C.; Andrew B. Reau, Phila., Pa.; Joseph W. Robinson, Jersey City, N. J.

WE are indebted to Mr. F. H. Bolton, Manager of the Alvord Company, of Detroit, Mich., for a copy of the Constitution and By-Laws of the Detroit Manufacturers' Club, which body holds in its membership line representatives of the business interests of Michigan's first city. A very sensible clause in the preamble of the Club's laws is this: "To encourage and upbuild our manufacturing enterprises (the backbone of our local and national prosperity), by a liberal policy as regards taxation." This clause would seem to have especial applicability to the Detroit Gas Company.

LAST week we had occasion to mention the incorporation of the Chemung Gas and Electric Light Company, which proposes to do business in Elmira, N. Y., in opposition to the present Elmira Gas and Illuminating Company. The Directors named in the Chemung incorporation are all said to be residents of this city, but they are not known particularly to gas fame in this vicinity. Some light, however, is thrown upon the parties they stand for, when it is said that Mr. Ferdinand McKeige, Secretary and Treasurer of the Standard Gas Light Company, of this city, and Mr. Geo. E. Woods, of the engineering staff of the same Company, were interested listeners at a meeting of the Elmira Common Council, at which the following franchise proposition was introduced by Ald. Watson:

Resolved, by the Common Council of Elmira that permission be and the same hereby is granted, and that the municipal authorities of the said city, by its Common Council, do hereby consent, that the Chemung Gas and Electric Light Company, shall be henceforth entitled to lay conductors for conducting gas through the streets, lanes, alleys, squares and highways in the said city, and manufacture, sell and furnish such quantities of gas as may be required in said city for lighting the streets and public buildings, and for other purposes, such permission and consent being given upon and under the following reasonable regulations hereby prescribed.

First.—The gas which shall be supplied by the said Company shall have an illuminating power of not less than 20 sperm candles, each weighing one-sixth of a pound, and burning at the rate, as near as possible, of 120 grains of spermaceti per hour, tested by a burner consuming 5 cubic feet of gas per hour, and shall comply with the standard of purity now or hereafter established by law.

Second.—The Company shall not charge, or be entitled to receive, for supplying gas for the public buildings owned by the City of Elmira, a sum to exceed the rate of $1.25 per 1,000 cubic feet of gas, nor, for gas supplied for lighting the streets of said city, a sum to exceed $22.40 cents for each lamp, burning 4,000 hours per annum, and consuming gas through a burner consuming 3 feet of gas per hour, under pressure of one inch, and such maximum rate for each lamp to include the supplying of gas; nor shall said Company charge for gas supplied to private consumers in the said city, a sum to exceed $1.40 per 1,000 cubic feet.

Third.—The said Company may be required to supply gas to the buildings owned by said city, situated on the line or lines of mains of the said Company, at the rate hereinabove specified, and whenever the proper authorities of said city shall call for proposals or estimates for furnishing illuminating gas to such buildings, or any of them, the said Company shall submit an estimate or proposal for supplying the same to such buildings as are situated upon such lines at a rate not to exceed the rate aforesaid.

Fourth.—All trenches or excavations which shall be made by the said Company for the purpose of laying its mains or conductors through any of the streets, lanes, alleys, squares or highways in said city, shall be filled in immediately after such conductors or mains shall have been laid, the earth thoroughly rammed, as the same is thrown into the trench or excavation, and the pavement replaced in good and workmanlike manner, according to the regulations of the Board of Public Works, and, in case said Company shall fail or neglect to replace such pavement or pavements to the satisfaction of the said Board, then the said Board shall have the right to cause the same to be taken

up and replaced in a good and workmanlike manner, and the expense of such work shall be charged to and paid by the said Company.

The said Board shall be entitled to appoint an inspector to superintend the refilling of all such trenches or excavations opened by said Company and the repavement aforesaid, and the said Company shall pay the salary of the said inspector, at the rate of $3 for each day actually employed in the discharge of his duties in superintending such work.

The said Company shall execute a bond to the city in the penalty of $5,000 for the faithful performance of the foregoing provisions in respect to the refilling of trenches and the relaying of pavements.

Resolved, That permission is hereby granted to the said Company, and the city of Elmira by its Common Council does hereby consent, that the said Company shall be entitled to lay, erect and construct suitable wires or other conductors, with the necessary poles, pipes or other fixtures, in, on, over and under the streets, avenues, public parks and places of the said city, for conducting and distributing electricity, and for using the same for light, heat or power in the said city, and the streets, avenues, public parks and places thereof, and the public and private buildings therein, and for such purposes to generate and supply electricity, and make, sell or lease all machines, instruments, apparatus and other equipments therefor; such permission and consent being given under the same regulations in respect to excavatings and pavements as are hereinbefore specified concerning the laying of mains or conductors for supplying gas.

THE ordinance was referred to the Public Improvement Committee and to the City Attorney for consideration and report. In an interview between a reporter of the Elmira *Advertiser* and Mr. McKeige, the latter said he hoped the application for a franchise would be granted before long, as the Company desired to lay 5 or 6 miles of pipe before the frost sets in; and that all the men employed on the work, with the exception of the foreman, would be Elmirans. Perhaps, too, if the franchise were granted right away, Mr. McKeige and his associates would have something tangible on which to force the proprietors of the present Company to name a price at which they would have to part with their property.

MR. GEORGE P. METCALF, Superintendent of Streets, South Framingham, Mass., recommends the passage of an ordinance prohibiting the local gas and water companies from opening any public streets, between November 1st and April 1st, except in cases of urgent need for making repairs to the said pipes.

ELSEWHERE we mention a movement inaugurated in Springfield, O., for the obtaining of a dollar gas rate for that city. Since that information was received by us we are informed that, at a special meeting of the Springfield City Council, held the evening of November 21st, convened mainly for the purpose of determining the rates that the Springfield Gas Light and Coke Company may charge for its product during the next 5 years, the following action was taken: The rate is to be $1.25 per 1,000 cubic feet, in case of prompt payment; but the Company may add 10 cents per 1,000 cubic feet on bills not paid at the Company's office before the 10th day of the month in which the bills were presented. Col. J. W. R. Cline, Gen. Bushnell's right hand man in the Springfield Company, deserves much credit for the tact displayed by him in pushing the ordinance to a binding termination. Ten Councilmen were present, and the vote was 9 in favor to 1 opposed.

STILL another hint from Springfield is to the effect that the proprietors of the Springfield Natural Gas Company have secured control, by purchase, of the plant and franchises of the Springfield Gas Light and Coke Company.

CAPT. JOSHUA T. FOSTER, one of the originators of the Malden and Melrose (Mass.) Gas Light Company, and for many years its President, died at his home in Malden on the 21st of November. Deceased, who was in his 86th year, was born in North Scituate, and in time became one of the most prominent constructors of sailing vessels in the world. In 1873 he built the full-rigged ship Pilgrim, the last vessel constructed in Medford, which was in "the fifties" a noted ship building port. He was a Director in the Bay State Brick Company and was Vice-President of the Medford Savings Bank. His wife and a daughter survive him.

WEST ALBANY, N. Y., is clamoring for a gas supply, so it is likely that the Municipal Gas Light Company, of Albany, will next spring extend its pipes through the village. The Company now supplies gas in West Albany only to the West Albany railroad shops and to the Stock Yards Hotel.

THE sale of the Norwich City (Conn.) Gas Light Company is to all intents and purposes an accomplished fact.

IT is reported that the McKim estate has determined to close down the plant of the Rhinebeck (N. Y.) Gas Company.

THE Towanda (Pa.) Gas Company has been absorbed by the Towanda Electric Illuminating Company, and the executive management of the combined enterprise is to be: President, S. W. Little; Treasurer and Superintendent, Charles P. Welles.

THE Brooklyn *Eagle*, of November 24th, had the following to say about the consolidation of the Gas Companies in that city:

"The consolidation of all the Brooklyn Gas Companies is at last an accomplished fact. The majority of the stockholders in the old Companies have exchanged their securities for the new, and there has been quite a lot of trading in them. There does not seem to be anything now which can prevent the new Company from carrying out the ideas which have been in the minds of some of the largest capitalists for the last dozen years. That is the manufacture of gas for Brooklyn under the management of one Company, with all the accompanying economies. There is no need of going over ancient history in local matters. The majority of people remember the gas war of about 12 years back, when what is known in business circles as the Standard Oil crowd, with the Fulton Municipal Company, raided the territory of every other Company in the city until they cried for mercy and secured it by contributions of peace offering substantial in character. It is also recalled that after the war was over gas securities regained their proper value and the same crowd which had caused their depreciation and bought them when low, sold them out, and the profit of their venture in Brooklyn has been variously estimated at from one to two millions of dollars. Judging from the present rate at which the securities of the new Gas Company are advancing the remembrance of former profits will be wiped out by the magnitude of the sum which will be made out of this deal. It will be remembered by people familiar with gas matters in this city that on September 1, 1894, the Beckton Construction Company, which was the vehicle by means of which J. Edward Addicks tried to bring about a consolidation of gas interests in this city, sold out one-half of its holdings in several of the Brooklyn Companies. There were 1,185 shares of Metropolitan, 20,016 of Brooklyn, 3,094 shares of Citizens, 375 shares of Fulton Municipal and 125 shares of Peoples. The lump sum paid for those securities was given out as being $785,000. The check which was paid over, if the statements which were made at the time are correct, was drawn by Mr. H. H. Rogers, who has managed about all of the gas deals in which the Standard Oil Company people have been interested as individuals. Any one who is nimble with a pencil can figure out the market value of the securities of the new Company which this crowd has received for those stocks alone. Taking the bonds at 107 and the stock at 84, it totals up to the the tidy sum of $1,835,300. The difference between the price paid and the present market value is $1,050,000. No one for a moment supposes that the stocks which were secured from the Beckton Company were all that the crowd held. It is well known that they were in the market during a large part of last fall and all the winter and this spring, and it was generally conceded that the majority of the stock in every one of the Companies, with the exception of the Nassau and the Williamsburgh, was controlled by the same people. It is, therefore, probably quite accurate, as a man pretty well posted in gas matters said, that even at present prices their profits are between three and four millions. The prospects of their securing even greater returns are excellent, for there seems to be a very good chance of the stock moving higher than it is at present. The way that people are figuring on the proposition is somewhat after this fashion: The output of all the Companies last year for which pay was received was 3,500,000,000 cubic feet. The profit made by a Company like the Williamsburgh, Nassau or Fulton-Municipal, which have works of the best kind and a large output, is nearly 50 cents a 1,000 cubic feet, which gives net earnings of $1,750,000. The fixed charges on the $15,000,000 of bonds which the new Company has issued is $750,000, and the net income therefor is according to that method of figuring $1,000,000. Others go even further and say that taking the output last year at 3,500,000,000 cubic feet it should be larger this year by 10 per cent. because of natural growth and because there is now no reason why the new Company should not canvass actively for business. Heretofore it has been the custom of each of the Companies to do no canvassing for fear of starting up a little gas war. It should also be possible to secure payment for a great

(*Continued on page* 902.)

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(*Continued from page* 901.)

deal more gas because a delinquent customer now has no alternative but to pay up or go without gas. The operating expenses and cost of manufacture should also be less because of the economies secured by consolidation. They take the margin of profit at only 40 cents a thousand cubic feet, and figure out the same results; that there will be $1,000,000 to be divided into dividends. On the other hand it is a source of mistery to the conservative investor how Companies which heretofore paid out in dividends and fixed charges about $750,000 can by consolidation do more than twice as well. The explanation given of this by the people who think that Brooklyn union gas is a good thing is that the Companies did earn very nearly that amount but that each was afraid to make public its earnings for fear of inducing a raid from some other Company or a strike by the legislators at Albany, and each one felt the necessity of saving its strength for a day when trouble might arrive. In addition to this they say that the new Company has several hundred thousand dollars worth of real estate to sell as soon as there is a good market for it. The talk seems to indicate that the active president of the new Company when the time comes for his appointment will be General James Jourdan. Mr. Stoddard has established himself in the new office of the Company in the old Brooklyn Company building, and Secretary Staniford of the Metropolitan Company is his assistant in the work of Treasurer."

New Power Plant of the Niagara Falls Hydraulic Power and Manufacturing Company.

The Canadian *Journal of Commerce* says that in view of the efforts being made to utilize the rapids of the St. Lawrence and the Ottawa along the shores of the Island of Montreal, for the purposes of supplying power and electric lighting to manufacturers and others, the following description of the power plant now being constructed by the Niagara Falls Hydraulic Power and Manufacturing Company will be of interest to the public.

The hydraulic basin from which water is now taken for furnishing power to the various mills supplied with power by this company is located parallel to and about 300 feet back from the edge of the high bank of the Niagara river on the Canadian side. For this new plant the water will be taken in an open canal from this hydraulic basin to a forebay 30 feet wide and 22 feet deep, which is now being built near to the edge of the high bank. From this forebay, penstock pipes built of flange steel, 8 feet in diameter, conduct the water down over the high bank 210 feet to the site of the power house on the sloping bank at the edge of the water in the river below the falls.

The site for the power house is now being cleared; broken and disintegrated rock, mixed with huge bowlders which have fallen over the bank in past ages, covered the site in places to a depth of 75 feet. The work of clearing this material from the site of the power house, which is now nearing completion, has been largely done by means of a giant or monitor. This is the machine so extensively used in the gold mines of the West for excavating by means of a stream of water. The machine in use at this point is the first used in the East. Below this *debris* is a stratum of Medina sandstone, on which the power house will stand.

The building will be 60 × 100 feet, the intention being to add to the length of the building (60 feet) and place other wheels, fed by separate penstocks, from the same forebay as above as demand arises. There are four turbine wheels of the horizontal type, furnishing about 8,000-horse power, to be located in the first floor of the power house. These wheels will work under a head of 210 feet, the highest head under which water has ever been used for power in the quantity proposed in this plant. The pressures exerted by water under this head are enormous, and every detail of the penstock and waterwheels must be designed with the greatest care to hold it.

The penstock leads from the forebay vertically about 135 feet to the top of the sloping bank, thence down the slope to the side of the station next to the bank, making the total length of the 8-foot pipe about 240 feet. Into the building the pipe, 10 feet in diameter, runs horizontally suspended over the tailrace. The thickness of the steel is 15-16ths of an inch. All horizontal joints are butt strapped, held with three rows of rivets on each side. The cross seams are all double riveted. The necessity for strong work in this pipe will be seen when it is remembered that the total pressure on the end of the pipe exceeds a million pounds. From this horizontal portion of the penstock the water is taken directly up through 60-inch valves on to the water wheels, which are supported upon iron beams stiffened by braces into the side of the tailrace. The four wheels for this plant are being built by James Leffel & Company, of Springfield, Ohio, under general plans and specifications made by the engineer of the Niagara Falls Hydraulic Power and Manufacturing Company. Three of these turbines are specified to generate each 1,700-horse power under a head of 205 feet, which is the minimum head estimated as obtainable, and to run at a speed of 250 revolutions per minute. As the ordinary head will be from 210 to 215 feet, the power of these wheels will be from 1,800 to 2,000-horse power each.

Magnesite Firebricks.

The London *Journal* "notes" that the familiar makes of firebrick are threatened by a new kind of refractory material occurring on the coast of Eubœa, Greece, in the form of magnesite ore—a dazzling white stone, which is actually being largely worked by a French company. The ore is shipped, both crude and calcined, being eminently suitable for lining furnaces. It is also used for certain purposes as a substitute for china clay. The most promising application of the material, however, is the making from it, after grinding and calcination, of firebricks by machinery. These bricks are fired at a great heat by Siemens gas furnaces, using a local lignite for fuel. They are reputed to stand extremely high heats for a long period. Their composition is guaranteed to be 95 per cent. of pure magnesia; analysis frequently giving the purity as high as 97.80 per cent. Magnesia powder is shipped from the same locality to lay the bricks with. The magnesia bricks are somewhat high priced, but this will not be a serious hindrance to their coming into extensive use in the arts if the material is really better for the construction of furnaces (to say nothing of crucibles and retorts) than the commoner materials employed for these purposes.

The Market for Gas Securities.

The market for Consolidated was last week as it has been for some time back. The opening to-day (Friday) came in at 148¼ to 149, and bidders were out in greater numbers than sellers. Everyone was waiting for the announcement of the dividend rate, which declaration is due to-day. Up to the time of writing (2 o'clock) the action of the Directors had not been promulgated. Other city shares were steady to strong, Mutual showing the highest bid figures yet made for it—203¼. New York and East River common is firmly held at 33 to 34, and Standard preferred also scored a good advance.

The shares of the Brooklyn Union Company have been marked up to 86, which we think ought to be fully representative of their actual value, especially in view of the fact that the Acme Gas Fuel and Construction Company, recently incorporated in New Jersey, proposes to manufacture and sell gas in Brooklyn. We have an idea that this Acme Company, at present so young and unobtrusive, is likely to find favor with the local authorities of the City of Churches.

Chicago gas sold down to-day to 60¼, but recovered somewhat after the mid day transactions. This stock looks to us a purchase. Baltimore Consolidated, in response to the threat of adverse legislation by the next Legislature on gas rates, sold down to 59¼. Bay State is dull, at 22½ to 23, and Laclede is also dull, at last week's quotations. Consumers, of Jersey City, also seems to offer a fair chance for a speculative turn, at the offering price of 91, but there as elsewhere the seeming chance of adverse legislation in respect of gas prices keeps investors on the wrong side. Gas bonds of all classes are in good demand, at advancing figures.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 Wall St., New York City.

December 2.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	147½	148¼
Central	500,000	50	150	..
" Scrip	220,000	..	100	..
Equitable	4,000,000	100	198½	201½
Bonds, 6's	1,000,000	1,000	106	..
" 1st Con. 5's	2,300,000	1,000	114	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	200	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	..
Northern	150,000	50	79	80½
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	33	34
Preferred	2,000,000	100	63	64
Bonds 1st 5's	3,500,000	1,000	101	102
" 1st Con. 5's	1,500,000	..	86	87
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	71½	72¾
Preferred	5,000,000	100	108	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	109	..
Yonkers	299,650	50	112	..
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	140	..
Citizens	1,200,000	20	70	..
" S. F. Bonds	320,000	1,000	..	101
Equity	2,000,000	10	..	..
" Bonds	1,000,000	..	..	..
Fulton-Municipal	3,000,000	100	220	..
" Bonds	300,000	..	103	..
Peoples	1,000,000	10	100	..
" Bonds, 7's	368,000	..	100	..
" " 6's	94,000	..	98	100
Metropolitan	870,000	100	200	..
" Bonds, 5's	70,000	..	..	..
Nassau	1,000,000	25	310	..
" Ctfs.	700,000	1,000	90	100
Williamsburgh	1,000,000	50	310	..
" Bonds	1,000,000	..	107	110
Out-of-Town Companies.				
Bay State	5,000,000	50	..	23
" Income Bonds	2,000,000	1,000	..	80
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	78	80
2d " " "	3,000,000	1,000	54	56
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	61	61½
Chicago Gas Lt. & Coke Co.				
Guaranteed Gold Bonds	7,550,000	1,000	94	94¼
Columbus	1,069,000	..	66½	67
1st Mortgage	1,065,000	..	94	95
Consumers, Jersey City	2,000,000	100	..	91
" Bonds	600,000	1,000	100	108
Cincinnati G. & C. Co.	7,000,000	100	203¾	204
Consumers, Toronto	1,800,000	50	184½	187
Capital, Sacramento	500,000	50	..	41
Bonds (6's)	150,000	..	..	..
Consolidated, Baltimore	11,000,000	100	59	60
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,400,000	..	..	..
Detroit	4,000,000	..	29½	30¼
" Con. Bonds	4,312,000	..	..	70
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	78½	78¾
" Bonds	2,000,000	..	87½	89½
Hartford	750,000	25	130	135
Indianapolis	2,000,000	..	..	148
" Bonds, 6's	2,650,000	..	103½	105
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	83	85
Bonds	1,000,000	1,000	85	87
Louisville	2,370,000	50	..	180
Laclede, St. Louis	7,500,000	100	22¾	23¼
Preferred	2,500,000	100	82	85
Bonds	9,084,400	1,000	97	97¼
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co.	1,000,000	..	75	..
Bonds, 6's	4,000,000	..	120	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	46½	..
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,800,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	70½	71
St. Paul Gas Light Co.	1,500,000	100	68½	70
1st Mortgage, 6's	650,000	..	88	90
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	..	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	68	70
Bonds, 5's	3,556,000	..	93	94½
Wilmington, Del.	500,000	50	188	190

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The Hillen Meter Co., Brooklyn, N. Y.	927

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio	925
M. J. Drummond, New York City	925
R. D. Wood & Co., Phila., Pa.	922
Warren Foundry and Machine Co., New York City	925
Donaldson Iron Co., Emaus, Pa.	925
Addyston Pipe and Steel Co., Cincinnati, O.	924

GAS BAGS.

Peerless Rubber Mfg. Co., New York City	905

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City	919

GAS COALS.

Penn Gas Coal Co., Phila., Pa.	917
Perkins & Co., New York City	916
Despard Gas Coal Co., Baltimore, Md.	917
Westmoreland Coal Co., Phila., Pa.	917
Shaner Coal Co., Philadelphia, Pa.	905
Berwind-White Coal Mining Co., New York and Phila.	916
Henry C. Scheel, New York City	917

CANNEL COALS.

Perkins & Co., New York City	916
Henry C. Scheel, New York City	917

GAS ENRICHERS.

Standard Oil Co., New York City	917
The Sun Oil Co., Pittsburgh, Pa.	917

COKE CRUSHER.

C. M. Keller, Columbus, Ind.	917

CONVEYING MACHINERY.

C. W. Hunt Company, N. Y. City	905

GAS GAUGES.

The Bristol Co., Waterbury, Conn.	905

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City.	915
Isbell-Porter Co., New York City	922

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Company, New York City	922
Continental Iron Works, Brooklyn, N. Y.	922
G. Shepard Page's Sons, New York City	923

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J.	918
B. Kreischer & Sons, New York City	918
Adam Weber, New York City	918
Laclede Firebrick Mfg. Co., St. Louis, Mo.	918
Cyrus Borgner, Phila., Pa.	918
James Gardner, Jr., Pittsburgh, Pa.	918
Henry Maurer & Son, New York City	918
Baltimore Retort and Firebrick Co., Baltimore, Md.	918
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.	918
Brooklyn Firebrick Works, Brooklyn, N. Y.	918
F. Behrend, New York City	905

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N. Y.	918
F. Behrend, New York City	905

INCANDESCENT GAS LAMPS.

Welsbach Light Co., Gloucester, N. J.	907

MICA GOODS.

The Mica Mfg. Co., New York City	905

BURNERS.

C. A. Gefrorer, Phila., Pa.	922
George Bray & Co., Leeds, England	908
Theo. Clough, Dobbs Ferry, N. Y.	904

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn.	905

GAS TUBING.

New York Gas Tubing Co., New York City	905

STREET LAMPS.

Bartlett Lamp Mfg. Co., New York City	919

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City	915
Greenpoint Chemical Works, Brooklyn, N. Y.	915
Henry W. Douglas, Ann Arbor, Mich.	915

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind.	912
Isbell-Porter Company, New York City	922
Connelly Iron Sponge and Governor Co., New York City	915

VALVES.

Ludlow Valve Manufacturing Co., Troy, N.Y..... 914
Chapman Valve Manufacturing Co., Boston, Mass..... 914
R. D. Wood & Co., Phila., Pa..... 922
Continental Iron Works, Brooklyn, N. Y..... 922
The P. H. & F. M. Roots Co., Connersville, Ind..... 912
Isbell-Porter Co., New York City..... 922
The Western Gas Construction Co., Fort Wayne, Ind.... 914

ELECTRICAL APPARATUS.

Wm. Henry White, New York City..... 923

GAS ENGINES.

Otto Gas Engine Works, Phila., Pa..... 888
The American Gas Engine Co., Phila., Pa..... 906

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City..... 924
W. G. & G. Greenfield, East Newark, N. J..... 924

PURIFIER SCREENS.

John Cabot, New York City..... 905

GAS STOVES.

American Meter Co., New York and Philadelphia..... 911
The Goodwin Meter Co., Phila., Pa..... 926
George M. Clark & Co., Chicago, Ills..... 909
Maryland Meter and Manufacturing Co., Baltimore, Md.. 926
William M. Crane & Co., New York City..... 909
Keystone Meter Co., Royersford, Pa..... 926
A. Weiskittel & Son, Baltimore, Md..... 584
The Wolff Gas Radiator Mfg. Co., New York City..... 907
Wilder Mfg. Co., Phila., Pa..... 905

CHINA GAS KILNS.

William M. Crane & Co., New York City..... 909

COIN WRAPPERS.

Alvord & Co., Detroit, Mich..... 905

GASHOLDER PAINT.

New York Marine Paint Co., Poughkeepsie, N.Y..... 914

RED CEDAR TANKS.

Williams Mfg. Co., Kalamazoo, Mich..... 864

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y..... 914

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 921
Continental Iron Works, Brooklyn, N. Y..... 922
Deily & Fowler, Philadelphia, Pa..... 924
Davis & Farnum Mfg. Co., Waltham, Mass..... 920
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 920
Stacey Mfg. Co., Cincinnati, Ohio. 923
R. D. Wood & Co., Philadelphia, Pa..... 922

PATENTS.

H. B. Willson & Co., Washington, D. C..... 917

DIVIDEND NOTICE.

OFFICE OF WELSBACH COMMERCIAL COMPANY,
40 WALL ST., NEW YORK CITY, Nov. 14, 1895.

The Directors have this day declared a quarterly dividend of two (2) per cent on the preferred stock, payable on Dec. 10, 1895, to stockholders of record at the close of business Nov. 30. Transfer books will be closed from Dec. 1 to 10, both inclusive. Checks will be mailed.

1068-3 EDWARD C. LEE, Treasurer.

FOR SALE,

Harris & Griffin Station Meter.

From the fact that we have to buy a much larger meter, we now offer for sale, at a bargain, a 48 x 48 inch Harris & Griffin Station Meter, now in use at our works.

CHAMPAIGN & URBANA GAS LT. & COKE CO.,
1,068-3 Champaign, Ills.

FOR SALE,

Gas and Electric Plant in Substantial, Growing Kansas Town of 5,000 People.

No bonds nor debts outstanding. It is a money maker. Present owners wish to retire from business. Will sell whole or half interest. $10,000 will secure half interest and the superintendency, at $75 per month. Address

1068-4 RODOLPH HATFIELD, Wichita, Kas.

FOR SALE,

Four Purifying Boxes, 8 ft. by 8 ft.,

with 6-inch Center Valves and Connections, in good order.

HOUSTON GAS LIGHT CO.,
1064-8 Houston, Texas.

GAS WORKS.

WANTED TO PURCHASE, whole or controlling interest in small Gas Company not having electric light attachment. Must be in New England, New York, New Jersey or Pennsylvania. Give particulars as to indebtedness outside of capital stock, selling price, population and kind of gas made. All communications will be treated as confidential. Address "INVESTMENT," care this Journal.

Proposals For Gasoline Lighting.

Sealed bids will be received at the office of the City Comptroller, Omaha, Neb., up to 5 P.M., Dec. 10, 1895, for lighting the streets of the suburbs of Omaha with Gasoline Lamps for the period of two years from the 29th day of January, 1896. Said lamps to give a light equal to sixteen (16) standard sperm candles, all burning together; the same to be lighted at sunset and to be kept lighted until sunrise every night in the year. The city will also receive bids on a moonlight schedule. In either case the contractor to furnish lamps, posts, glass and burners; to light and extinguish, clean, repair, move and re-locate same; to change all burners at least every thirty (30) days, and keep same in good order at all times. A certified check of $100, payable to the city of Omaha, to accompany each bid as a guarantee of good faith. No bid will be considered unless accompanied by a copy of this advertisement. The right is reserved to reject any or all bids.

THEO. OLSEN, Comptroller.
OMAHA, NEB., Nov. 21, 1895.

Coal Tar For Sale.

CONSUMERS GAS COMPANY,
TORONTO, CANADA, Nov. 27, 1895.

Tenders will be received until noon on Friday, Dec. 13, for the Coal Tar produced at this Company's works, on a basis of one, three, or five years, at a price per barrel of 35 imperial gallons (equal to 42 American gallons). Particulars as to quantities, facilities, terms of payment, etc., may be obtained on application to the undersigned, to whom tenders may be addressed. No tender necessarily accepted.

WILLIAM H. PEARSON,
1069-2 General Manager & Secretary.

Proposals for Coal Tar.

The North Adams (Mass.) Gas Light Company invites Proposals for its annual output of Gas Tar, amounting to 600 barrels. The gas made on these works is strictly produced from the carbonization of the best gas coal, no oil being used even for enriching purposes.

1064-tf F. S. RICHARDSON, Treasurer.

POSITION WANTED

As Supt. or Manager of a Gas Works or Gas and Electric Light Works.

Fifteen years' experience as Manager of Gas Works and six years Gas and Electric Light Works. Good reasons for wishing to change present employment.

1043-tf Address "Y. B.," care this Journal.

WANTED,

By a man who has had a round experience in the manufacture and sale of gas,

A Position as Supt. of a Large or Small Gas Works.

Is capable and energetic, and is willing to begin at a moderate salary. Address

1082-tf "B.," care this Journal.

WANTED,

A Second-Hand Gas Engine of Some Standard Make,

that will develop from 8 to 10 horse power. Address, giving price and full particulars,

CAPITAL GAS AND ELECTRIC LT. CO.,
1065-6 Frankfort, Ky.

BRISTOL'S RECORDING PRESSURE GAUGE

For Continuous Records of
Street Gas Pressure.

Simple in Construction,
Accurate in Operation,
Low in Price,
Fully Guaranteed.

Send for Circulars.

THE BRISTOL CO.
Waterbury, Conn.

Received Medal at World's Columbian Exposition.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to STROH & OSIUS, Pat'ees. of Mich. Ammonia Works, Detroit, Mich.

FOR SALE.

Approved Very Fine Formula
(PATENT OR SECRET)
For Manufacturing Incandescent Gas Light Mantles.
350 per Cent. Net Profit.

Address "J. D., 491," care of RUDOLF MOSSE,
BERLIN, S.W., GERMANY.

THEO. CLOUGH,

MANUFACTURER OF

Clough's Patent Adjustable Gas Burners, Maxim Burners for Gasoline Gas Machines, Natural Gas Burners.

E. H. Nickel Tips for Water Gas.

Iron Burners of Every Description. Prices and Catalogue on Application,

THEO. CLOUGH, - - - - - Dobbs Ferry, N. Y.

GOIN! GOIN!! GOIN!!!

should be neatly and accurately wrapped before banking. We make the *only* device that will do it properly. *Successful bankers* give these to their customers. If you prefer to buy, ask any stationer for them, or write to us for prices and free samples.

ALVORD & CO., Mfrs. **Detroit, Mich., U.S.A.**

Get Our Prices on

Mica Chimeys

For Welsbach Lights,

AND ON

Mica Canopies.

The MICA MFG. CO.,

Micasmiths,

88 Fulton Street, - - New York City.

G. W. HUNT COMPANY.

THE HUNT TIP CAR.

COKE CARS for Gas Works,
TIP CARS for Carrying Ashes,
CHARGING CARS for Bringing Coal from the Storage Bins to Boiler Room and Retort Houses.

INDUSTRIAL RAILWAYS

Specially designed for handling material in and around

Gas Works, Coal Yards, Factories, Etc., Etc.

45 BROADWAY, - - NEW YORK.

If You Want the Best GAS-TIGHT Tubing,

BUY OF THE

NEW YORK GAS TUBING CO.

771-779 Greenwich St., N. Y.

GUARANTEED NOT TO STIFFEN. **Makers of All Kinds of Flexible Tubing.**

The Celebrated SHANER GAS COAL

CORRESPONDENCE SOLICITED.

Is Mined and Shipped from the Best Gas Coal Basin in Pennsylvania.

SHANER COAL CO., - 1326 Chestnut Street, Philadelphia.

F. BEHREND,

SOLE IMPORTER OF THE CELEBRATED

German (Stettin-Didier) Clay Gas Retorts,

BLOCKS, TILES, FIREBRICKS, FIRE CEMENT,

Stettin "Anchor" & "Eagle" Brand Portland Cement

10 & 12 Old Slip, New York.

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.

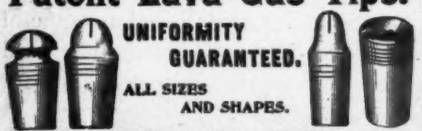
306-310 Eleventh Avenue, New York.

We also make the Cheapest and Strongest

REVERSIBLE BOLTED TRAYS IN THE MARKET

Send for Circulars.

Patent Lava Gas Tips.



UNIFORMITY GUARANTEED.

ALL SIZES AND SHAPES.

D. M. STEWARD MFG. CO.,
CHATTANOOGA, TENN.

TRIUMPH REGENERATIVE GAS HEATER

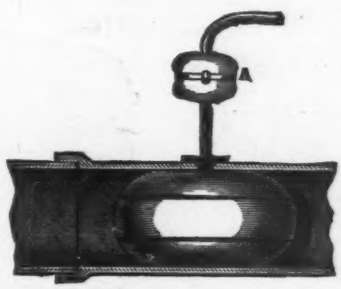
Wilder's Patents, Nov. 15 & 22, 1892.

Heats both air and gas before combustion. Gives high flame temperature and maximum economy, with entire freedom from smoke and smell. Radiates heat to the floor. Warms the feet and does not overheat the head. No headache and no colds caused by cold feet where this Heater is used. Has Group Governor, which regulates gas volumetrically proportionate to heat desired; the only correct regulation for stoves and furnaces. A gas heater, if a free gift, is still costly and extravagant if it burns gas wastefully. The Triumph Heater is constructed upon correct principles, and gives results not obtained with any other.

Write for descriptive circulars and order sample Heater.

WILDER MFG. CO., 816-822 Cherry St. Phila.

Peerless Patent Improved Gas Bag



These Gas Bags are used to stop the flow of gas while repairing or making alterations in gas mains. There have been numerous cases of workmen being badly injured, and sometimes fatally, by the escape of gas resulting from the bursting of a bag, and our patent improvement is designed to obviate such calamities. The indicator *A* shows unerringly when the bag has been sufficienty inflated to pack the main, and when the pumping should be stopped. Our Bags are made of a rubber stock especially prepared to admit of great distension, and to resist the action of Oils, Gases, Naphtha and other residuum in the mains, and they are made with lapped joints, which adds greatly to their strength.

3-in.	Gas Bag,	each,	$0.60	12-in.	Gas Bag,	each,	$5.00
4 "	"	"	.80	16 "	"	"	8.35
5 "	"	"	1.05	20 "	"	"	12.00
6 "	"	"	1.75	24 "	"	"	17.00
8 "	"	"	2.65	30 "	"	"	27.50
10 "	"	"	3.75				

The Peerless Rubber Mfg. Co.

16 Warren St., N. Y. City.

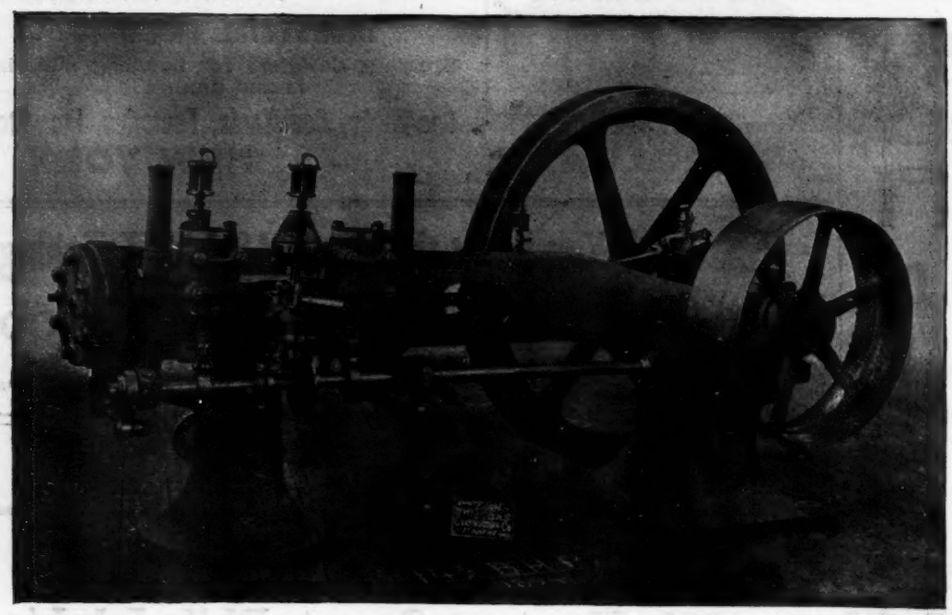
WM. W. GOODWIN, Prest. O. N. GULDLIN, V.-Prest. & Treas. H. B. GOODWIN, Sec. ERNEST F. LLOYD, Asst. Sec

THE AMERICAN GAS ENGINE CO.,

MANUFACTURERS OF

The Double-Acting Gas Engine,

Under the Patents of Griffin, and Dick, Kerr & Co., of London and Kilmarnock.



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Single Cylinder.

Impulse Every Revolution.

(Two Strokes.)

15 to 500 Horse Power.

For General Work and Isolated Electric Plants.

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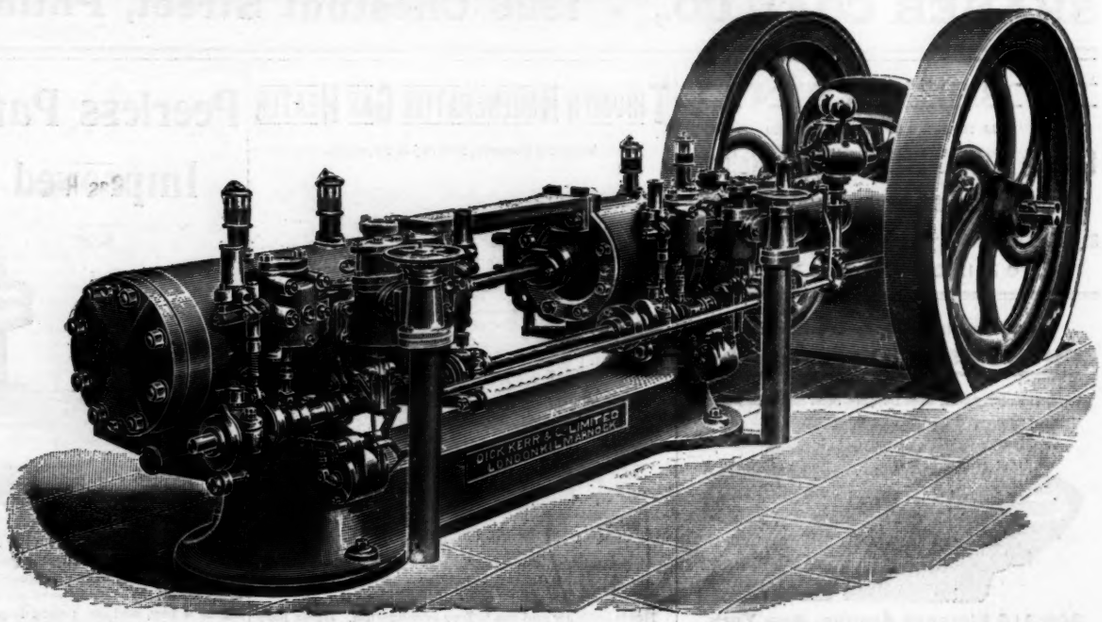
Tandem Cylinder. Impulse Every Stroke. 100 to 1,000 Horse Power.

For Central Stations and all work requiring extreme steadiness.



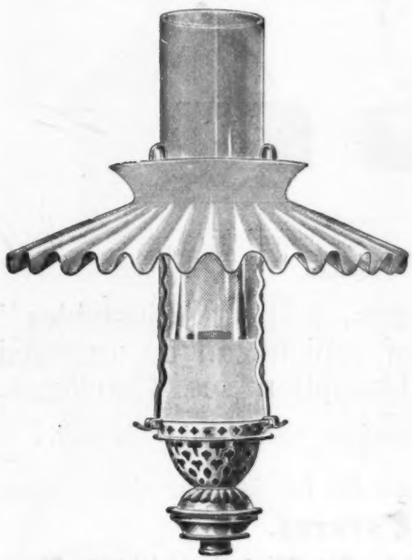
ESSENTIAL PRINCIPLE.—An impulse at each end of piston; using half force to each impulse; doubling the steadiness; reducing the wear on moving parts, and weight for given power. **CONSTRUCTION.**—The piston rod works through stuffing box in front end of cylinder, and connecting rod is carried in a cross-head working in a slide in frame, as in ordinary steam engine practice. All valves are of the poppet type, operated by cams on a single cam-shaft, giving positive movement to every working part. Tube or electric ignition. **RESULT.**—An engine of extreme simplicity and steadiness of action, the even wear on the cylinder and all working parts assuring increased economy, long life, and minimum cost in repairs. **RECORD.**—Successful and constant use in Great Britain for the past eight years. Address

W. W. GOODWIN, President, Lock Box 718, Philadelphia, Pa., or
THE WESTERN GAS CONSTRUCTION CO. Bldrs. & Gen. Agts., Fort Wayne Ind.

The Improved

Welsbach Light.

No. 31 Burner, with Nos. 10 and 43 Shades.



No. 31 Burner, with No. 74 Shade.

Made by the

Welsbach Light Company,

Gloucester City, N. J.

Sole Manufacturers for the United States.

The WOLFF Gas Radiator.

Size, 33 Inches High, 21 Inches Wide and 10 Inches Deep. The Trilby Heaters are furnished in Brass, Copper-Bronze and Nickel Plate.

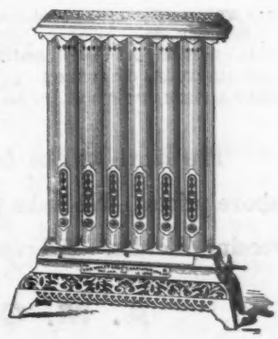
The Most Ornamental and Economical Gas Heater in the World.

The WOLFF Gas Radiators are no Longer an Experiment.

Heating with gas as a fuel instead of wood or coal was made practicable only four years ago, when the first WOLFF Gas Radiator was made. Since that time we have supplied Gas Radiators to heat all kinds of Rooms, Halls, Stores, Churches, Theaters, etc.; they are used in Bed Chambers, Sick Rooms, and wherever heat is required. And, because of their great success, several imitation Gas Radiators are offered, "said to be as good as Wolff's;" but none of them are as good. The WOLFF Radiator gives more and better quality of heat, at less cost, than any gas heater in the market.

In our Trilby Heater we again offer something **new, novel** and **good,** as well as beautiful and pleasing to the eye. Most Stoves, Heaters and Radiators in use heat the **top** of the room, leaving the **floor** cold (hence keep the head warm and the feet cold). Our Trilby Heater warms the floor first; then the heat rises gradually, warming the whole room comfortably, cold air being drawn in from the bottom (passing between the heated radiating flues) and thoroughly warmed before passing out at the top, while the gas, mixed with air, is burned in our "Patent Incandescent Iron Fires Burners," which greatly intensifies the heat, causing an extra amount of heat to be radiated, or thrown off onto the floor, while the products of combustion are carried up through radiating iron flues to the top of the Trilby Heater, and downwards and out through opening to flue or chimney pipe connection, making a current or outlet for burnt gas or impure air, thus causing perfect ventilation in the room.

The Trilby uses less gas and gives more and better heat than any other Gas Radiator in the market.



MANUFACTURED BY

THE WOLFF GAS RADIATOR MANUFACTURING CO.,

Office, 164 Franklin St., New York.

Bray's Patent "Enamel" Gas Burners.

Bray's "Special" and "Adjustable" Burners

Are the Cheapest, Most Economical and Most Durable in existence, and will, at their REDUCED PRICE, save their cost in gas alone in forty hours' use.

Union Jet. Slit Union. Batswing. Adjustable.

The "Specials" are made to Suit Low and High Pressures. The "Adjustables" consist of two Burners screwed together, the sizes of which can be arranged to suit any Pressure and Consumption. For full description see Catalogue.

See that **"Bray's Special"** or **"Bray's Adjustable"** is stamped on each kind of Burner.

ACETYLENE AND RICH OIL GASES.—We now make Burners suitable for use with these Gases.

TO BE HAD OF DEALERS THROUGHOUT THE STATES.

IN NEW YORK: E. P. Gleason Mfg. Co., 181 to 189 Mercer St. Consolidated Gas Co. of New York, 4 Irving Place.

IN BOSTON, MASS.: Waldo Brothers, 88 Water Street.

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The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

A. M. CALLENDER & CO., 32 Pine Street, New York.

Jewel Gas Heaters and Radiators.

54 Styles. From $4 to $30.

The Finest and Largest Line in the World . . . .

Many New Designs.

It Will Pay You to Have the Jewel Catalog.

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Gas Fires, Gas Logs, Fire Place Heaters, Ranges, Broilers, Laundry Stoves,

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Tailor Stoves, Soldering Furnaces, Griddles, Waffle Stoves, Hot Plates, Gas Kilns, etc., etc.
A New Line of Radiators.

THE "VULCAN" PERFORATED GAS RADIATOR.

Finished in Antique Brass or Polished Nickel. The Handsomest, Most Economical and Best Radiators made.
Send for Complete Catalogue.

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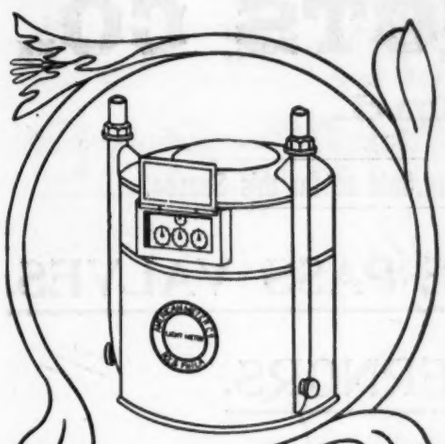

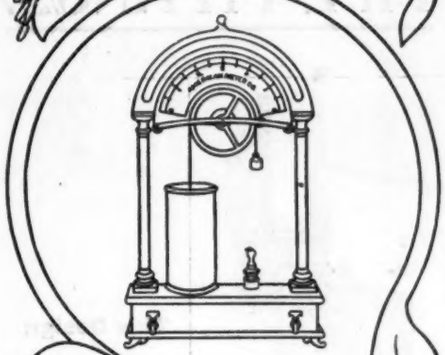

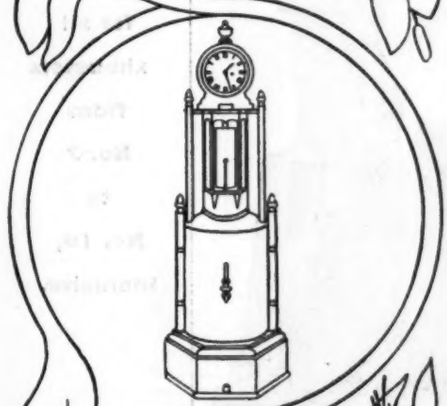

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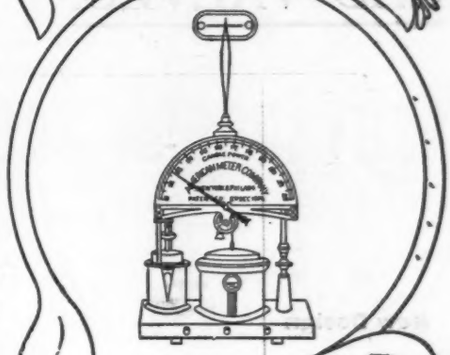
PUBLIC LIGHTING TABLE.

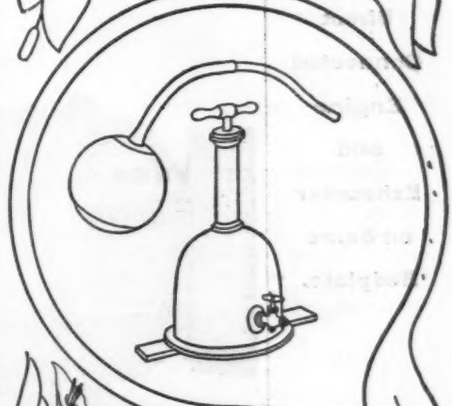
DECEMBER, 1895.

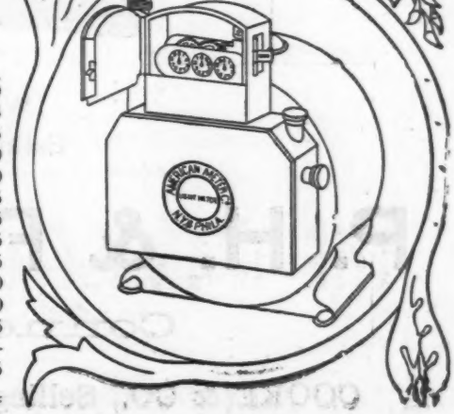
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Sun.	1	No L. FM	No L.	4.20	6.10
Mon.	2	No L.	No L.	4.20	6.10
Tue.	3	5.00 PM	6.30 PM	4.20	6.15
Wed.	4	5.00	7.40	4.20	6.15
Thu.	5	5.00	8.50	4.20	6.15
Fri.	6	5.00	10.10	4.20	6.15
Sat.	7	5.00	11.20	4.20	6.15
Sun.	8	5.00 LQ	12.40 AM	4.20	6.15
Mon.	9	5.00	1.50	4.20	6.15
Tue.	10	5.00	3.00	4.20	6.20
Wed.	11	5.00	4.10	4.20	6.20
Thu.	12	5.00	6.10	4.20	6.20
Fri.	13	5.00	6.10	4.20	6.20
Sat.	14	5.00	6.10	4.20	6.20
Sun.	15	5.10 NM	6.20	4.20	6.20
Mon.	16	5.10	6.20	4.20	6.20
Tue.	17	5.10	6.20	4.20	6.20
Wed.	18	5.10	6.20	4.20	6.20
Thu.	19	5.10	6.20	4.20	6.20
Fri.	20	8.00	6.20	4.20	6.20
Sat.	21	9.00	6.20	4.20	6.20
Sun.	22	10.00	6.20	4.20	6.20
Mon.	23	11.00 FQ	6.20	4.20	6.20
Tue.	24	12.00 AM	6.20	4.20	6.25
Wed.	25	1.00	6.20	4.20	6.25
Thu.	26	2.10	6.20	4.20	6.25
Fri.	27	3.20	6.20	4.20	6.25
Sat.	28	4.20	6.20	4.20	6.25
Sun.	29	5.30	6.20	4.20	6.25
Mon.	30	No L.	No L.	4.20	6.25
Tue.	31	No L. FM	No L.	4.20	6.25

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146.30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45







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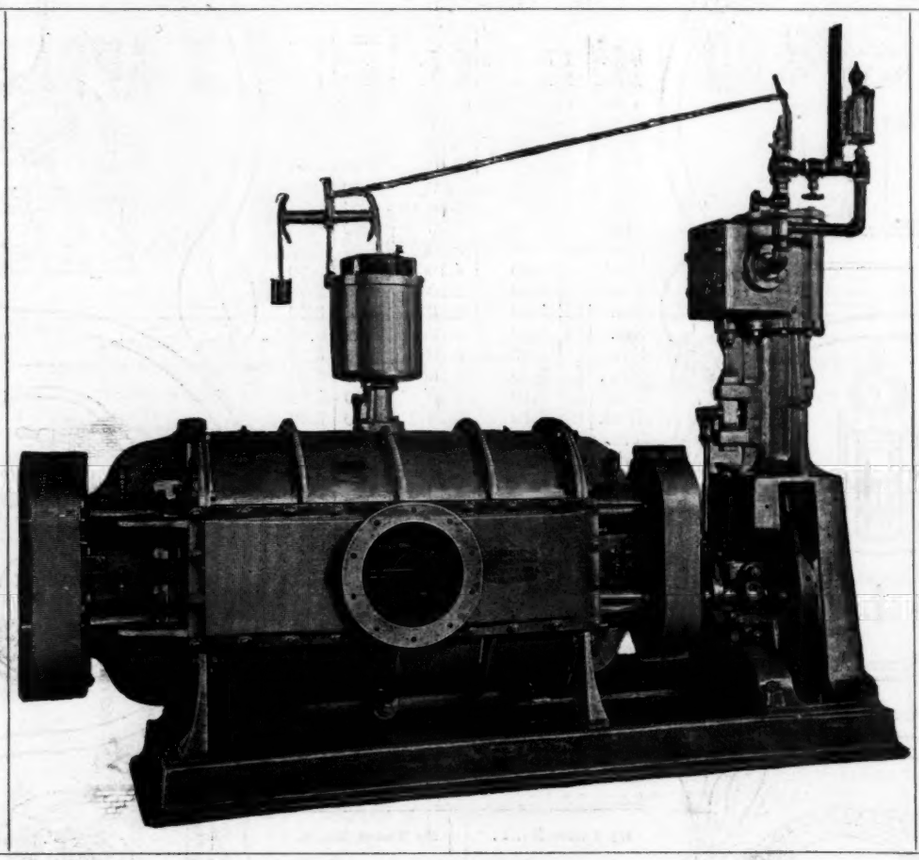

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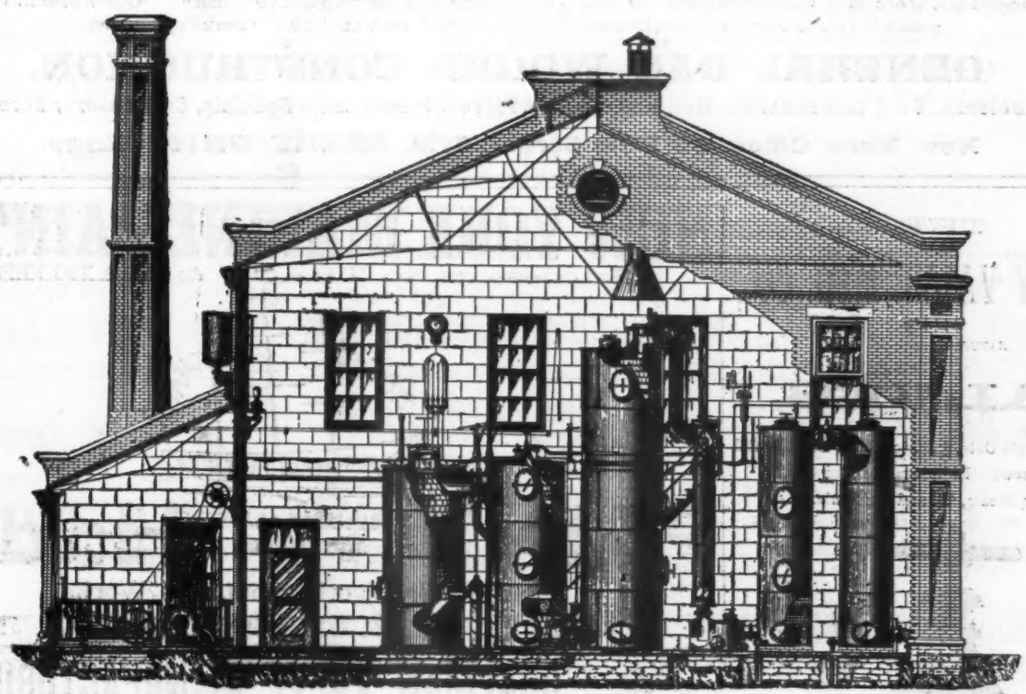

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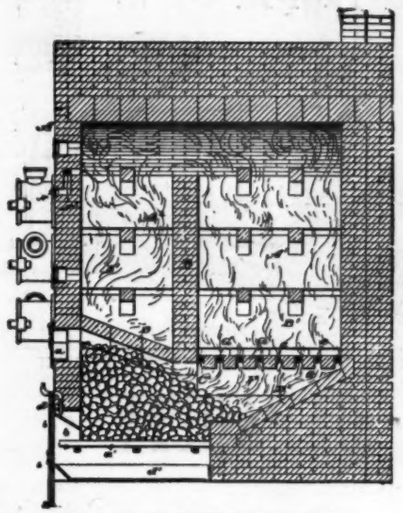

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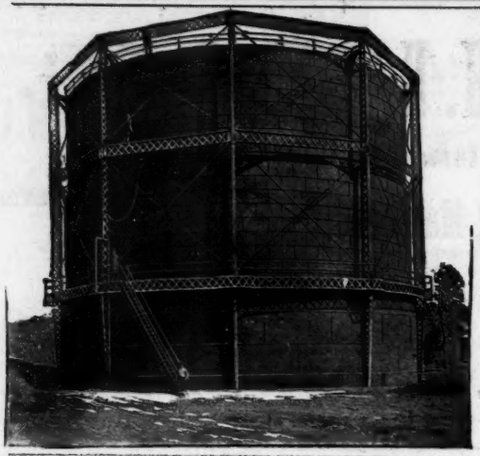

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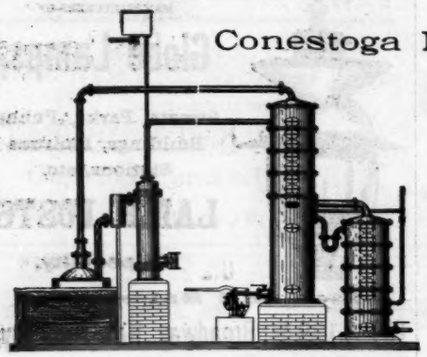

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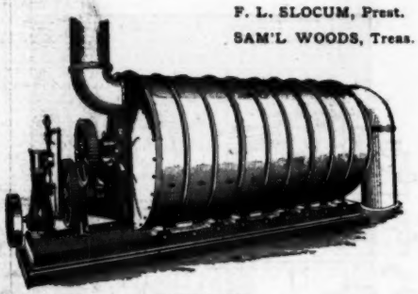

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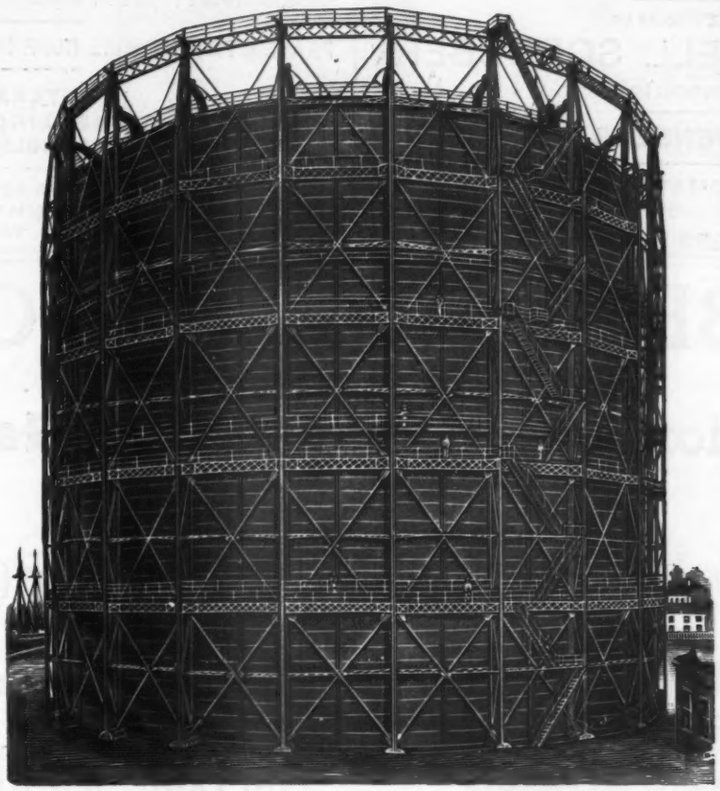

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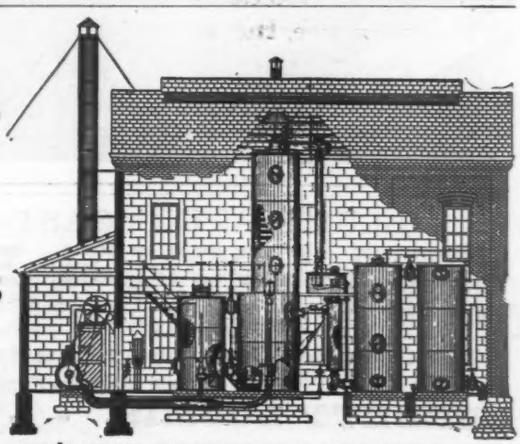

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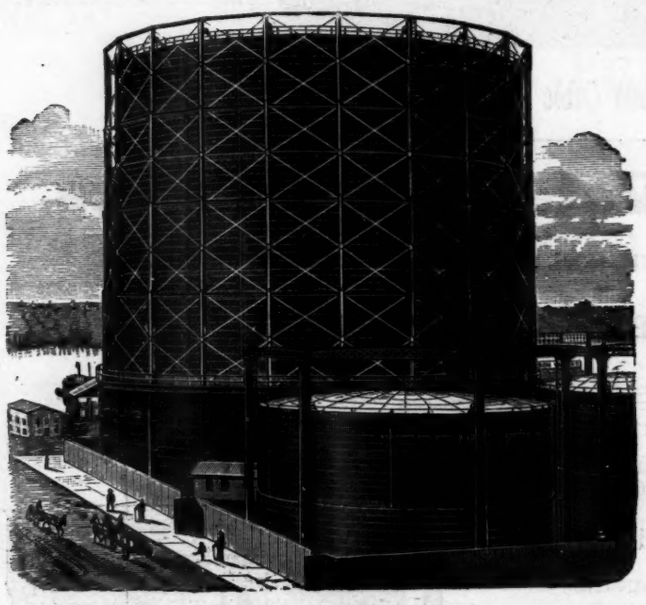

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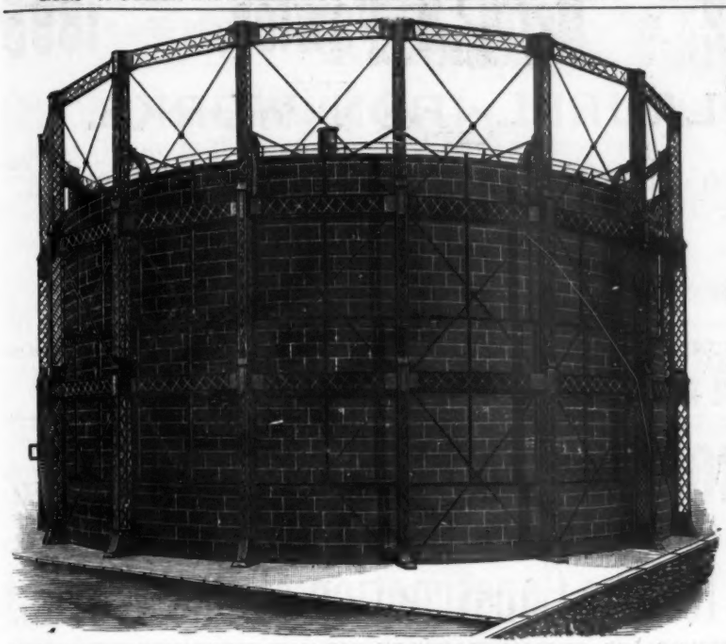

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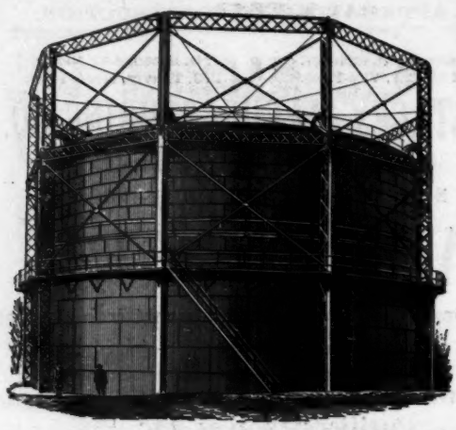

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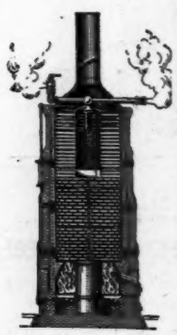

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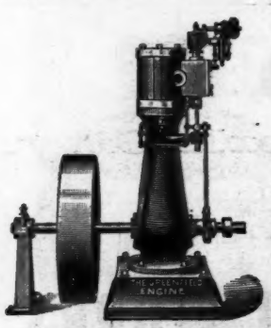

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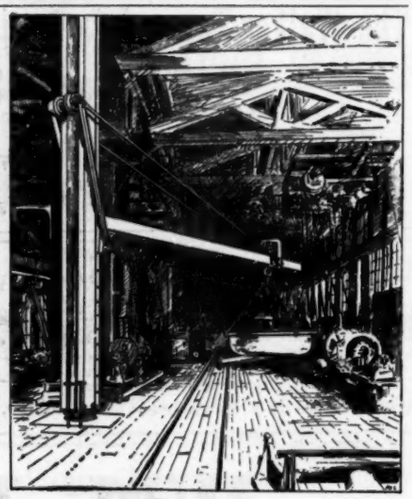

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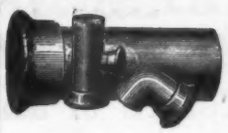

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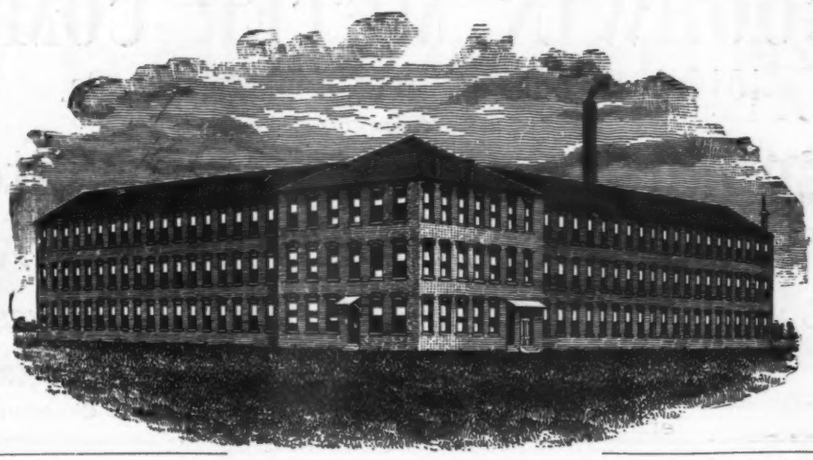

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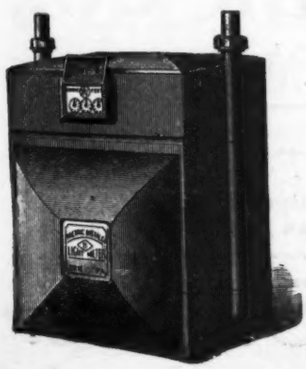

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